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CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES—
Wrinkle Department, American Gas Institute 221
Fourteenth Annual Meeting, Pacific Coast Gas Association 221
EDITORIALS—
Briefly Told 221
By-Products Made Remunerative—Gas Not Responsible for Death to Crabs—Notes.
Recent Patent Issues 222
Twenty-ninth Annual Meeting, Western Gas Association—Official Report—Revised by the Secretary—Continued from page 187.... 222
Second Day. Afternoon Session—The Mutual Advantage to be Derived through Co-operation between Engineering Schools and those Engaged in the Gas Business by Prof. Charles F. Burgess—Discussion—Report of the Memorial Committee—Third Day, Morning Session—*Labor Saving Machinery for Medium Sized Retort Houses by Mr. F. H. Shelton—Discussion.
*Using Gas Pipes for Carrying Wires, by Mr. George D. Rice..... 232
ITEMS OF INTEREST FROM VARIOUS LOCALITIES 233
Camp Hill Grants Franchise—McDonald Meter Company Builds—Yakima Plant Burnt—Clerk Here—Dover May Change Hands—Carbon Dead—Auburn Price Fixed—Linton Goes to Vicksburg—Lane Goes to Richmond—Toronto Men Incorporate—Pettigrew to Buy Sioux Falls—San Antonio's Taxes Increased—Dogs Advertise Gas—Beach Leaves East St. Louis and Goes to Little Rock—Leominster to Merge—New York Commission Considers Applications—Danbury to be Investigated—Wilmington Franchise—Abel Goes to Long Branch—And Other Items.
The Market for Gas Securities 235

[OFFICIAL NOTICE.]

Wrinkle Department, American Gas Institute.

It has been decided to continue the Wrinkle Department work in connection with the American Gas Institute, and the undersigned having been elected joint editors of same, earnestly appeal to the members to send in contributions at an early date. Do not hesitate to send what you have, accompanied by a full description or sketch of same, and assist in making the first meeting on October 16th, 17th and 18th, at Chicago, Ills., a grand success. We remain, yours truly,

W. E. STEINWEDELL,
719 Citizens Building,
Cleveland, O.

B. MCADAM,
Milwaukee Gas Light Co.,
Milwaukee, Wis.

[OFFICIAL NOTICE.]

Fourteenth Annual Meeting, Pacific Coast Gas Association.

OFFICE OF THE SECRETARY,
925 FRANKLIN STREET,
SAN FRANCISCO, CAL., July 16, 1906.

To the Members of the Pacific Coast Gas Association—Gentlemen: Although somewhat disfigured, San Francisco is still in the ring, and, Phœnix-like, has already risen from its ashes so that the size of the bird is plainly discernible. We have still left, a few choice meeting places for conventions, and the 14th annual meeting, will be held, as per last adjournment, in the city and county of San Francisco, on Tuesday, Wednesday and Thursday, September 18th, 19th and 20th, 1906. You need not be reminded of the fact that John Martin is the President, to be assured that the program for the next session will outshine in brilliancy, that of any in the past. Good papers on live topics will be furnished, the usual banquet and outing will take place, and it is anticipated that the attendance will far excel that of any previous year. Due notice of papers to be read, and those appointed to discuss them will be given you. It is advisable that you notify this office immediately upon receipt of this, of your intention to be present, in order that accommodations may be reserved for you. Do not forget the "Wrinkle" and "Experience" Editors. While their notebooks may be full of the idiosyncrasies of earthquakes and fire, there is still room for a few more "batches" for those of you who are without the belt of shaking Earth. I am, as I hope you all are, for Greater San Francisco. JOHN A. BRITTON, Secretary.

P. S.—Members will please advise the Secretary of any change in their address.

BRIEFLY TOLD.

BY-PRODUCTS MADE REMUNERATIVE.—We have not yet reached the scarcity of raw materials when it pays to spend much money in labor on culm for briquettes, etc., but the price of our staple product, gas, is being constantly reduced either voluntarily on the part of the gas companies, or by the dictates of legislation, and although a greater sendout of gas permits of a reduction in price, the latter is in greater proportion to the former, and the gas manager is looking around for a means of offsetting this inequality. He can find it in more extensive uses and greater refinement in his by-products without going out of his sphere of business. As an illustration, weak ammonia liquor is sold by many gas companies without concentration, netting the companies, as a rule, not over 20 cents per ton of coal carbonized, others by the installation of concentrators net from 27 to 30 cents per ton of coal carbonized, after paying interest and depreciation on the installation of the concentrating plant, and there are a few others who go still further by making aqua ammonia, thus making the maximum profit themselves, instead of the chemical companies to whom they sell the raw by-product. Anhydrous ammonia for ice making machines is in greater demand every day, in the same ratio that manufactured ice is taking the place of natural ice. The Columbus Gas Company in its palmy days made a good round profit in the manufacture of tar paper, and tar is the basis of a long list of compounds that have a ready sale. In these days of good road "talk" much could be accomplished both for the improvement of roads and for the companies that have tar for sale. In our issue of the JOURNAL of July 23d, we published a translation from the *Journal für Gasbeleuchtung* on the use of tar abroad for the laying of dust, and preservation of roads. Gas men can do no better missionary work for creating a demand for tar which has fallen off to such an extent that it is being used as a fuel, than to bring this matter to the attention of their automobile friends and associations, and to the municipal authorities in their cities. It is not because the city street departments do not wish to furnish fine roads, but often because they do not just know how to overcome the difficulties that present themselves. Monaco, Paris and some English cities are using tar on roads successfully, so can we. We call your attention to the reference to this in Mr. Norton H. Humphry's letter in our issue of last week

There is not a company in the United States that recovers cyanides, and this is done rather successfully abroad. For those neighboring companies not large enough to go in for the refinement of their by-products, we would suggest some plan of co-operation with a central plant. It is time that the constructors of gas machinery look closer into by-product machinery and work with the gas men to secure a larger field for the gas companies' by-products.

GAS NOT RESPONSIBLE FOR DEATH TO CRABS.—The following extract is taken from a paper read by Mr. R. M. Redding at New Orleans, La., the caption of which is "A Study of the Effect of New Orleans Canal Waters on Crab Life:"

"By testimony of fishermen the greatest mortality among the crabs is shortly after heavy rains, when the city refuse is swept down the canals. The mortality among the crabs caught by this rush is nearly 100 per cent. This is what one would expect since the sweep of the city sewage in large volumes fills the canals with sewage in the first and second stages of purification—a state in which little free oxygen is found in the water. Rideal, Long and Fowler demonstrated that heavily charged water undergoing purification contains but little free oxygen, and remains in this condition until the point of reaeration is reached. The time required for this point to be reached is much greater than that required for sewage to travel from the city to the lake. Long followed the Illinois for a distance of 160 miles and, although the water was constantly being diluted, found the evidence of final stages only far down the river. The conclusion logically follows that the death of the crabs is not due to poison directly injected into the canals, but is due to the absence of free oxygen in the water, assisted possibly by the presence of intermediate products of oxidation of organic matter. These conditions are brought about by the water in the gutters and canals being heavily charged with organic matter which standing stagnant for days in the hot sun undergoes decomposition of organic matter, thereby denuding the water of its free oxygen."

Mr. Redding made exhaustive tests and experiments with live crabs submerged in different percentages of pure water and canal water in which latter gas plant drainage had run, and into which the street drainage with its decaying organic matter only had run. It is certainly interesting to know that the gas company is not responsible for every trouble in its town!

NOTES.—

THE many warm personal friends of Mr. George G. Ramsdell will regret to learn that a sudden and critical illness overtook him on July 19th, resulting in the necessity of an operation upon him for appendicitis, at his home on the 24th inst., which has proved successful; and although he shows signs of the illness he has passed through, he is remarkably bright and cheerful, and his full recovery is looked forward to within the next few weeks.

ALBERT J. WEBER, President Adam Weber Sons Company, has received an order for several complete new Adam Weber half-depth gas benches from the Halifax Electric Tramway Company, Ltd., Halifax, N. S. Also additional orders for refractory material from the New Amsterdam and Standard Gas Light Companies, of New York city.

THE Lawrence (Mass.) Gas Company has contracted with a Pennsylvania company for the erection of a 140-foot steel and cement stack to be erected at its electric power plant on the south canal.

THE Gas Machinery Company, of Cleveland, O., has been awarded a contract for a 60-inch ammonia still and a 5,000,000 cubic feet per day capacity P. & A. coal gas extractor for the Vintondale Colliery Company, of Vintondale, Pa.

Recent Patent Issues.

Prepared for the AMERICAN GAS LIGHT JOURNAL by Royal E. Burnham, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 10 cents.

826,036. Gas generator. Anton von Kerpely, Vienna, Austria-Hungary.

826,214. Apparatus for manufacturing gas. John E. Allen, Columbiana, O., administrator of James J. Johnston, deceased, assignor to Albert C. Ellis, Pittsburgh, Pa.

826,260. Gas stove. Charles Markmann, New York city.

826,511. Method of manufacturing gas. John E. Allen, Columbiana, O., administrator of James J. Johnston, deceased, assignor to Albert C. Ellis, Pittsburgh, Pa.

[OFFICIAL REPORT—REVISED BY THE SECRETARY—CONTINUED FROM PAGE 187.]

THE TWENTY-NINTH ANNUAL MEETING, WESTERN GAS ASSOCIATION.

HELD IN CLEVELAND, O., MAY, 16, 17 AND 18, 1906.

SECOND DAY—AFTERNOON SESSION.

The President—I will now call for the paper on

THE MUTUAL ADVANTAGE TO BE DERIVED THROUGH CO-OPERATION BETWEEN ENGINEERING SCHOOLS AND THOSE ENGAGED IN THE GAS BUSINESS,

by Prof. Charles F. Burgess, of the University of Wisconsin. We are fortunate this afternoon in having Prof. Burgess with us. Professor Burgess, gentlemen.

Professor Burgess—I beg to thank the President of our Association for asking me to present some ideas which have developed in connection with our work in establishing a course for gas engineers. I suppose it is as a representative of one of the few engineering colleges in the country that have taken up the instruction in gas engineering that I have been asked to submit a paper.

The primary object of technical education as developed in this country appears to be the elevation and development of the individual, while the promotion of greater material prosperity is secondary. In attaining this primary object the success has been phenomenal, and as the late Professor J. B. Johnson has said: "Engineering education to-day speaks for itself more forcibly than anyone can speak for it."

In training young men in the fundamental principles of science and engineering, so that they may successfully handle many problems of industrial life, a certain and close relationship has been established between the technical schools and the industrial world, a relationship analogous to that of producer and consumer, both finding a common ground of interest in the product, the graduate of the technical school. The success of the technical educator's work is estimated largely by the degree with which the man who has taken the course of training which he offers meets the requirements of the employer, of the man whose efforts are concerned most directly with the promotion of material progress. In this mutuality of interests co-operation is possible, and it is the purpose of this paper to touch upon some of the features of co-operation between engineering schools and that branch of industrial life concerned with the production and utilization of gas.

James Watt and William Murdock, working at the same time and in the same shop, laid the foundations of those two branches of engineering which were to influence most profoundly the exterior forms of society—steam engineering and gas engineering, respectively.

These twin industries have developed along somewhat divergent paths; the former flourished more rapidly from the beginning, but during recent times gas engineering has made such rapid progress that it bids fair to attain ultimately the greater field of usefulness.

The transformation and utilization of steam power involved a complexity of mechanism which long ago gave rise to the need of technically trained men, and the technical schools co-operated by establishing courses in steam and mechanical engineering to help in the training of such men.

That similar co-operation between the technical schools and the gas engineering profession was not effected until a much later period might be construed by some as demonstrating that progress in gas engineering did not require it. Though not within the scope of this paper, it is interesting to speculate as to the causes of the later recognition given by our technical schools to gas engineering. Whether it may be attributed to lesser relative importance of gas engineering to modern civilization, or to smaller amounts of capital involved, or to greater simplicity of problems connected with gas engineering progress, the demand in the gas field for technical graduates has been less until recent years than it has been in civil, mechanical or electrical engineering lines.

Not a great many years ago a presidential address before this Association contained the statement that "Gas engineering can neither be taught successfully in schools, nor does the practice of it demand a scientific education as a requirement." It is possible to find men who will say that the efforts which certain technical schools are making to provide for a special training for the gas engineer are to a certain extent misdirected, and engendered by an over-enthusiastic attempt of educators to find profitable positions for the young men in their institutions.

It is scarcely more than a third of a century ago that an engineering education had for its one object the training of the civil engineer. The growing industrial demands later led to the establishment of courses in

mechanical engineering, then electrical, mining, sanitary, municipal, hydraulic, structural, metallurgical engineering, and so many other kinds that a contemplation of them all will lead us to say that this is truly an age of specialization.

That this specialization has been brought about largely through the demands of industrial conditions is illustrated by a series of resolutions passed a few years ago by the Pittsburgh Foundrymen's Association and later by the National Association:

"*Resolved*, That the foundry industry has arrived at a point where there is a demand for managers properly trained in the principles of scientific and commercial founding.

"*Resolved*, That a representative body, such as the American Foundrymen's Association, be requested to draw the attention of institutions of learning in this country to this fact, and to urge them to take the necessary steps to supply the demand."

Various other requests of a like nature might be cited. The gas industries have placed a similar request before the engineering colleges, perhaps not formally in the manner above outlined, but in a manner none the less insistent, by first offering employment to a large number of engineering graduates, and more recently by requesting more graduates than the supply affords. This is a condition which effectually disposes of arguments put forward from time to time disparaging college education as a path to highest success in the gas business, and it will not be attempted herein to justly further the attempts which some of our technical schools are now making to train men for gas engineering.

For this profession the requirements are such that none of the older established courses meet them in a satisfactory manner, the principal shortcoming being insufficient attention to chemistry and chemical technology. Perhaps a half-dozen technical schools in this country are now offering courses in chemical engineering, courses in which one of the purposes is to train men for the gas industry as well as for other analogous industries in which a knowledge of chemistry with other branches of technology is important. An outline of the course which was adopted at the University of Wisconsin a year ago is appended herewith, not as an example of an ideal course, but as being more specifically illustrative of what some of the technical schools are doing toward co-operation with the gas interests in training men for this profession.

In entering upon a discussion of the advantages to be derived through mutual co-operation between engineering schools and those engaged in the gas industry, it may be desirable to point out some of the various methods in which co-operation might be effective.

It would appear that much of the difference of opinion which exists between the technical school and the practical man would be removed, and much of the criticism which is made of the former would be rendered unnecessary if there were a thorough understanding upon the part of the industrial man as to just what the purposes of the technical school are. There are many who hold that the technical educator falls far short of success from the fact that his graduates can not step at once into the management of works, equipped not only scientifically and theoretically, but with a knowledge of technique, of business details, and with ability to handle men. The engineering graduate is not, and has never been, claimed to be a finished engineer. The purpose toward which the administrations of engineering colleges direct their efforts is to train young men into resourceful and exact thinkers, men with a fundamental knowledge of the laws of nature and the means to utilize nature's forces. In other words, the object is to produce not finished engineers, but young men of capacity for rapidly becoming engineers when thrown into industrial work.

That nothing more than this is claimed for our engineering graduates is demonstrated by various facts. The degree which the majority of our institutions bestow upon their 4 year men is the Bachelor's degree. Such colleges recognize that professional attainments must supplement a college course before the recipient may be entitled to the designation "engineer," and at the University of Wisconsin, as well as in the various other technical schools, one of the requirements is that a graduate must have had at least 3 years of professional work, one of which must have been in a position of responsibiltty, before his engineer's degree will be conferred upon him.

It is true that some technical schools bestow the title of "engineer" upon its students who have had four years of study. The writer believes this to be an unfortunate procedure so far as it places technical schools in somewhat the same position of a merchant who explains to a dissatistied customer who found that the "genuine Spanish leather" which he had purchased was only a varnished burlap, that that is exactly what is meant by "genuine Spanish leather."

The criticism which has been so frequently raised against college men, that they are consumed with conceit of their attainments, and thus set the practical men of the factory or workshop against them, is rapidly coming to have less ground. It is probably no exaggeration to state that there is not a technical school in this country that does not endeavor to impress upon its students that they have not passed the apprenticeship stage, and that the engineering graduate is not necessarily the man who is going to occupy the highest planes in his profession. In this effort the faculties have been highly successful in spite of various counteracting influences. The principal difficulty in inculcating this frame of mind is that the demand for graduates has become larger than the supply, and most of the members of the senior class have had several offers of employment made to them some months in advance of graduation.

That the average present day engineering graduate has an appreciation of his limitations is amply demonstrated by the fact that a good percentage of the members of the graduating classes are entering the apprentice courses of various large industrial establishments at a wage hardly high enough to pay actual living expenses; it is testified to by the fact that it is very common to find men who have distinguished themselves in college life working beside Mexican laborers in a construction gang, or contentedly working in a manhole as a helper and obeying orders from a practical man who may neither read nor write. In fact, as has been stated by a prominent British engineer, in reporting upon his investigation of educational conditions in this country, "The know-it-all college man has almost vanished from the workshop, though a tradition of him and his eccentricities still lingers"

The technical man can, therefore, co-operate to a considerable degree by acquainting himself with the purpose of the educator, with the claims which he makes for his product, and with the methods through which the product is manufactured.

The various courses in chemical engineering which are being given at several institutions in this country differ materially in character. Some are better than others. There have been no long years of practice leading to uniformity and the establishment of the best method. The courses have been laid out in accordance with the beliefs of the heads of the respective courses as to what the practical requirements are. The administrators of technical schools offering such courses are prevented from providing completely for the work in the manner in which they wish to carry it out, through various limitations set by local conditions. The funds available may be inadequate to equip an ideal laboratory, or to provide for the most efficient instructional staff, and the crowded conditions of our technical schools may make it difficult to secure suitable class room and laboratory space. These limitations will disappear with time, and through the co operation which might be expected from and should be offered by the industrial men, our courses in chemical engineering are bound to take rank with the other important engineering courses which have been longer established.

The question of funds has been and always will be a vital question in the conduct and enlargement of engineering schools. While tax payers in many of our states are providing liberally for technical schools, and while large donations are being received from alumni and friends of endowed institutions, the demands are increasing at such a great rate that the funds for providing for the same are seldom in sight. When our universities are faced with a probable deficit or are in urgent need of additional funds to carry on their work, it is quite customary to look to the alumni for assistance, expecting that men who have obtained their educations at such universities and have gone out into industrial life and become wealthy, should be willing to give to their *Alma Mater*.

Another class of people may be looked to for assistance, namely, manufacturers and industrial people who are more or less directly benefited by the things accomplished through the technical schools. The form which the assistance takes from this class of contributors is varied. It may be funds for building, equipment, the endowment of chairs for specific lines of instruction, or for research work. There is scarcely an important engineering laboratory that has not been materially assisted through the donation of equipment from the manufacturer or the loan of machinery for a more or less indefinite period; and it is the exception rather than the rule that a manufacturer is not willing to sell apparatus to an engineering college at a price not greater than the actual factory cost.

In the effort to turn out broadly educated young men for the chemical industries the management of the gas industries can lend assistance to the technical colleges in various ways other than the above mention. Most of our courses provide for about 3 months' vacation in the sum-

mer, during which time little or no supervision of the time of the students is exercised. At the University of Wisconsin the requirement has recently been inaugurated that engineering students shall spend at least 6 weeks during one of his vacation periods in the machine shop. He is also required to accompany an inspection party which makes a tour of large industrial establishments. If, on account of expense or for other reasons, a student is unable to take this trip, he is required to spend some time during the summer vacation in studying one or more industrial plants. It is suggested that for students who propose to enter the gas business a more profitable method of employing one or more vacation periods would be in working in subordinate positions in a gas works, and the writer would advocate the adoption of this as a requirement of the course if suitable arrangements could be made with gas works to take such young men for short periods of time before graduation. A plan similar to this has been put into successful operation in other lines of engineering work, and there appears to be no reason why the managers of gas works might not find it possible to co-operate with the universities in like manner. The kind of work which an undergraduate student might do during such period of employment would not probably be of great value to the gas works, though while it would be possible, it would not be advisable to require the student to work for no compensation, since he will take a greater interest in and profit more by his work if he sees that it has some value measurable in dollars and cents; since in some other lines of manufacture employers not only take on undergraduate students for vacation periods, but are actually soliciting them to accept employment at a fair living rate of pay, it would be an unpopular requirement that would force a student to work for no compensation in any particular line of work outside of the university laboratories.

As previously intimated, a fair percentage of our engineering graduates accept the advantages offered by apprenticeship systems for graduates which have been established by various manufacturers. Through the advantages which such systems afford the graduates are willing to accept employment at a lower initial salary than could be received where no such system prevails. Many concerns who employ large numbers of such students each year have taken up this matter of apprenticeship for engineering graduates and, while in the subdivided gas industry such a system might be difficult to establish, through the co-operation of an organization such as this Western Gas Association a satisfactory plan might be worked out. There are various objections to apprenticeship systems as well as arguments for them, and while the writer does not at this time wish to advocate them in connection with gas work, it might be a matter worthy of consideration.

While the elevation and development of the individual is the primary aim of the ordinary college course, the technical schools have other highly important functions, one of them being the carrying on of research and investigation work. As our schools are at present run this research work is done by undergraduate students in the preparation of their theses, by graduate students who are specializing in certain definite lines of work, and by the instructional force. The usual character of the undergraduate research work is not such as to make it of great value to the industries, although valuable contributions are sometimes made. The primary object in requiring a student, before graduation, to carry on a piece of investigation is to throw him as largely as possible upon his own resources; to develop his capabilities of independent reasoning and thinking; to give play to his ingenuity, and to impress him with the importance of planning and laying out a piece of work in advance of its execution. Where a student shows marked ability in this respect the results of his work may be of practical importance. In the carrying out of this work the gas industries may offer assistance and encouragement. The local company near the University of Wisconsin offers to students the privilege, not only of visiting and carefully studying the operation of the plant, but also of making any tests and investigations which are desired, the only restriction placed upon them being that the operation of the plant shall not be materially interfered with. A spirit of competition among thesis students may be advantageously fostered by award or some other formal recognition of work of exceptional merit.

The research work done by graduates under direct supervision of the instructional force, and the work done by the instructors themselves, may have for an incentive the advantage to be derived through a solution of technical problems or the hope of addition to scientific knowledge. The importance of this kind of investigation to the gas industry at large hardly needs argument, and the reason that so little of it has been done in this country is that the demand for operating engineers has been so great that it is much more difficult to induce competent students to remain in the research laboratory after graduation. For this reason research along technical lines does not compare favorably in amount and quality of work done with departments of physics, chemistry, botany and the like and with technical schools abroad. Industrial men have it within their power to assist in promoting this work by advocating its importance and by assisting in establishing equipment and facilities for efficiently carrying on investigation of the many problems constantly arising in industrial operations. The Michigan Gas Association has materially promoted this kind of work by establishing a graduate scholarship at the University of Michigan, and the quality of the work which has been done through this assistance and under the able direction of Professor White, appears to have amply justified the appropriations which have been made. Through the more general establishment of graduate scholarships at the various technical institutions in which the facilities are such that high grade work can be carried on, much encouragement could be given for advanced research. If such scholarships amounting to several hundred dollars per year be open to competition, not only to the graduates of the institution in question, but to others in the industrial field who are competent and desirious of carrying on investigations, it is quite probable that a considerable amount of talent might be put to work in acquiring information of which the gas industries are in need.

Coming, finally and briefly, to the advantages to be derived through co-operation above referred to, it is hardly necessary to enumerate them, since they are largely self-evident. Co-operation will enable the technical schools to more nearly attain the purposes for which the endowments and appropriations for the support of the same are made, *i. e.*, the moral and material betterment of society. The industrial men while sharing in these larger benefits can, by the efficient conduct of technical schools, secure for the industrial needs a class of men competent to work into the management and development of gas interests. The development of research work may make it possible for the gas profession to profit through discovery, through added scientific knowledge, and through affording facilities whereby practicing engineers may carry on certain investigations which have an immediate bearing on their business. Advantages might accrue to them in much the same way that the agricultural interests have been benefited by the magnificent work accomplished at our various agricultural experiment stations.

The summer apprenticeship system above referred to would help the work of the technical schools and incidentally acquaint the employer with the students in such a way as to enable him to make a satisfactory choice of future employees.

A criticism frequently made, especially by the utilitarian, upon the character of the work done in scientific laboratories, is that it is too theoretical, that it has not immediate value, that the study of "the condensation of succinylosuccinic acid diethyl ester with guanadine" should give way to a thorough investigation of the condensation of tar. If this criticism is justified it may arise through lack of suitable co-operation between the laboratory investigator and the technical man, and it is entirely conceivable that a "getting together" may benefit the scientist by impressing him more thoroughly that many problems await investigation which afford opportunities for highly scientific work and the results of which will at the same time have a marked utilitarian value. That the advantages of such co-operation will have the element of mutuality in it is self-evident.

On the other hand, science for science's sake, is a motto, from the wearing of which no attempt at discouragement should be made, for many of the great blessings which come to mankind through discovery have resulted from the indefatigable labors of those men who have worked to increase the sum total of human knowledge and without the hope of immediate practical utility of such knowledge.

APPENDIX.—*Chemical Engineering Course at University of Wisconsin.*

Purpose of the Course.—It is the purpose of the Chemical Engineering course thoroughly to train students in the fundamental principles of both chemistry and engineering and to give such other subjects as will so far as possible contribute toward a liberal education. Specialization along narrow lines is not provided for, particularly, in the undergraduate work, since it has been shown by experience that the technique of any line of industrial work is most profitably acquired by a student after he leaves college. A certain amount of attention is given, however, to purely technical subjects for the especial purpose of setting forth the correlation of chemistry and engineering, emphasizing the dependence of practice upon laws and principles rather than upon empirical rules, and in giving training in the application of engineering and scientific principles to investigation and original research.

It is held that a chemical engineer should have as thorough a founding in the principles of engineering as a mechanical, civil or electrical engineer should have, and the course here outlined is arranged to accord with that belief. In addition to this he should have an equally thorough founding in the principles of chemistry. To provide satisfactorily for such training within four years seems impossible and, therefore, a 5-year course is offered. It is not practicable, for the present at least, to make the fifth year obligatory, and the work is so arranged that the student who finds it impossible to remain more than four years, will have had, at the end of that period, a course of study which has carried out, so far as four years will permit, the idea of a combined chemical and engineering course. If a student so desires he may, at the end of the four years, receive the degree of Bachelor of Science in this course; if, however, he completes the fifth year he will receive the degree of Chemical Engineer. While the fifth year is made optional, it is strongly recommended for men who propose to enter chemical engineering work, as in many respects it is the most important year of the course. It is in this year that specialization is provided for, and during it the student will be put upon his own resources and given training in investigation work which developes those most important attributes of a successful engineer—resourcefulness, ingenuity, and ability to apply general knowledge and scientific prineiples to specific problems. A thesis embodying the results of a laboratory investigation on some chemical technology problem constitutes one of the requirements for the fifth year, and in such cases where the B.S. degree is taken at the end of the fourth year a similar thesis will be required.

The outline of study which has been adopted for the chemical engineering course is the result of an adaptation of local facilities to meet, so far as possible, the ideas of prominent chemical engineers and others deemed competent to judge the requirements of a satisfactory course. There is, naturally, a wide divergence of opinion among various authorities, as shown by the marked variation of the chemical engineering courses given by the different technical schools. It is held that a safe course will be pursued if the training shall be equally directed toward turning out a good engineer and a good chemist. The course which has been adopted, therefore, apportions a student's time so that, after making allowance for languages, composition, mathematics and physics, it is equally divided between what might be called engineering subjects and those relating to chemistry. It should be noted that the schedule of studies does not show the actual number of hours required in the class and laboratories, and that a count laboratory hour in work done in the chemistry department is three actual hours, while in the engineering laboratories two actual hours per week is equivalent to one-fifth study.

Options.—About one-fourth of the time of the fourth year and two-thirds of that of the fifth can be devoted within certain limits as the student may wish. He may specialize in one of the various lines of chemistry, or in electro-chemistry or gas engineering, the choice being governed by the particular line of work for which he wishes to fit himself.

Gas Engineering.—So numerous and promising are the opportunities for chemical engineers in the gas industries that it seems desirable to arrange a series of optional studies, which, taken in connection with the required studies of the chemical engineering course, will afford the best training.

Inspection Tours.—An inspection tour by the members of the fourth-year class will be made each year. In this tour great manufacturing establishments and other important private and public engineering works in Chicago, Milwaukee and elsewhere are to be visited. These tours will be made under the guidance of the professors, and are deemed an essential part of the student's work.

Non-resident Lecturers.—It is the practice of the college to invite each year a number of prominent engineers to deliver one or more lectures before the student body on various phases of engineering practice. The purpose of these lectures is to enliven the interest of the student and to broaden his horizon rather than to give specific instruction. The following are some of the subjects touched upon during the last two years: The Chemical Engineer; The Ceramic Industries; Reinforced Concrete; The Engineer as a Business Man; Portland Cement Manufacture; Gas Engineering; Sewage Disposal.

Thesis.—Each student who receives a degree is required during his last year to present a thesis embodying the results of experimental investigation or the working out of some problem along the line of chemical technology. The purpose of this thesis is to develop in the student the habit of independent thought and of working upon his own initiative.

In the basement of this building are located the electrical and other furnaces, grinding, crushing and mixing machines, polishing and plating outfit, storage battery, store rooms and research rooms. On the main floor are located the offices, general laboratory, research laboratories and class room, and on the second floor are the electrolysis, photometric and gas and fuel analysis laboratories.

For technical gas, fuel and oil analysis and the study of refractory materials, the equipment comprises furnaces, pyrometers, calorimeters, meters and other analysis and testing appliances. The photometric equipment of the adjoining electrical laboratories offers additional facility for the practical testing of illuminants.

The equipment for the manufacture of chemicals from raw materials and for the study of chemical technology problems includes steam and vacuum evaporator, centrifugals, tanks, filter presses, crushing and grinding machinery, air compressors and vacuum pump, and this equipment is to be materially augmented during the coming year.

For high temperature work various types of furnaces are available, including those of the applied electro-chemistry laboratories. Electric furnaces of various types are supplied with power from a direct current generator of 125-horse power capacity, and from an alternating current dynamo capable of delivering 200-horse power.

Balance rooms and space for analytical work, with necessary equipment, are provided for, as well as a room equipped for the microscopical analysis of materials.

Course of Study for Students in Gas Engineering.

First Year.—First Semester.	Periods per Week.
German or French	4
English	3
Mathematics, algebra	5
Mechanical drawing, sketching and working drawings	3
Shop work	1
Chemistry, general	3
Second Semester.	
German or French	4
English	3
Mathematics, trigonometry and anal. geom.	5
Mechanical drawing	3
Shop work	1
Chemistry, general	3
Second Year.—First Semester.	
German or French, technical	3
Mathematics, calculus	5
Physics	5
Mechanical drawing, descriptive geometry	3
Chemistry (qualitative)	4
Second Semester.	
Mathematics, calculus	3½
Mechanics	5
Physics	5
Surveying	3
Chemistry (organic)	4
Third Year.—First Semester.	
Mechanics	3
Materials of construction	2
Physics, precision of measurement	3
Steam engineering, thermo-dynamics	2
Machine design, kinematics	3
Chemistry (quantitative)	3
Physical chemistry	2
Second Semester.	
Mechanics, strength of materials	1
Machine design	3
Steam engineering, thermo-dynamics	2
Steam laboratory	1½
Hydraulic engineering	3
Structural engineering, masonry	2
Chemistry (quantitative)	2
Physical chemistry	3
Chemical machinery	3
Fourth Year.—First Semester.	
Electric generation and distribution	2
Electric laboratory	1
Machine design	2
Structural engineering, building construction	2
Steam laboratory	3
Gas and fuel analysis	2
Industrial chemistry	3
Organic chemistry	5
Second Semester.	
Electric generation and distribution	2
Electrical laboratory	1
Hydraulic engineering	3
Contracts and specifications	1

Technology of fuels	2
Industrial chemistry	5
Photometry	1
Gas engines	3
Structural engineering	3

Fifth Year.—First and Second Semesters.

Metallurgy	3
Chemical technology (thermal efficiencies)	3
Chemical technology (manufacture and distribution of gas)	5
Thesis and electives	9

Courses from which electives may be chosen and in which specialization may be made:

Applied electro-chemistry.	Assaying.
Advanced physical chemistry.	Structural engineering.
Advanced inorganic chemistry.	Steam engineering.
Advanced organic chemistry.	Electrical engineering.
Geology.	Chemical technology.
Mineralogy.	Manufacture of beet sugar.

Discussion.

The President—Mr. Forstall, may we hear from you?

Mr. Alfred E. Forstall—Mr. President, with much of what is contained in this paper I entirely agree, and especially with that portion of the statement quoted from a presidential address delivered to this Association which refers to the impossibility of teaching gas engineering in schools. Although Mr. Burgess does not place himself definitely on record as to his position on this point, his views, as to the degree that should be conferred upon the student who has successfully completed one of the regular 4-year courses in a technical school, seem to indicate that he also believes that it is impossible for such a school to turn out, unaided, an engineer of any kind, and I feel sure that he will agree that all that can be done by the technical school is to give its students a training that will enable them to become engineers more quickly and easily, and also to become better engineers, than they or any other men of equal ability could without this training. If this view of what can be accomplished by technical education is accepted as correct it becomes an important question how far this education can be specialized with advantage, and my answer to this question would be "not very far." I think that a technical course should begin with much the same studies as now form the beginning of an academic course, with modern languages in place of Latin and Greek, the student being required, however, to take the larger number of hours per week that are characteristic of technical courses as compared with academic courses and to take his work more seriously than is usually the case with his academic confrère. This part of the course should also include more mathematics than the academic course and, during it stress should be laid upon the acquirement of accuracy and facility in the use of the English language both spoken and written. After, say, 2 years of this general education, the technical part of the course would be begun and continued for 2 years more. Made general at first, during the last year it would be specialized into, let us say, civil, mechanical, electrical, mining and chemical engineering. During the 2 years devoted to the technical studies, stress should be laid upon the necessity for accuracy in calculation as well as in method, and the acquirement of the ability to apply rapid methods of checking mentally the probable accuracy of any results obtained by calculations. In addition, since the successful engineer soon becomes a business man, some instruction should be given in business methods and accounting. There would be very little opportunity for specialization in such a course and, if the student were willing and able to do so, it would be a good thing for him to spend another year or two in study along the special line of engineering that he intends to pursue, but the men who were only able to spend 4 years in college would be better qualified to become engineers in any line by such a course as is outlined above, than they would be by the more highly specialized courses now given. Engineering schools can therefore co-operate best with the gas industry by refusing to yield to any pressure that may be put upon them to establish a special course in gas engineering and by making the course in chemical engineering that they provide as broad as possible. The suggestion made by Mr. Burgess in regard to co operation between the gas industry and the schools by the former, arranging to give students he opportunity to acquire practical knowledge and a fair compensation is a good one. The gas business cannot get along without the technical graduate, and the better his preparation for his work the greater the benefit that will be obtained from him. The endowment of scholarships for the purpose of original research into the physical and chemical problems that have to be solved in the manufacture of gas, after the example set by the Michigan Association, is also a promising field for co-operation that would result in great benefit to the gas industry. The establishing of a rational and definite method of condensation that will prevent trouble from naphthaline would alone compensate for the cost of many such scholarships, and it is only by means of such work as is being done in connection with the Michigan Association scholarships that a method of this kind can be developed. The different kinds of co-operation that Mr. Burgess has named all promise good results for the gas industry and should be encouraged by gas men. We need more accuracy in obtaining data, more careful correlation of the data when obtained, and more scientific reasoning as to what they prove, and in all these directions the engineering schools can and are very willing to help us if we give them the opportunity.

The President—We have a contribution from Dr. Harrop, of Milwaukee, which I will ask Mr. Rollin Norris to read.

Mr. Norris—Before starting to read this, if Mr. Doty will allow me, I would like to say something myself. I happen to have come in contact with the graduates of a good many technical schools and to have been in a position to follow up their work, and there are two or three points in the training of a technical school which I would like to emphasize. Of course, first, there is the grounding in general principles which enables a man to think clearly when he gets into new situations. Then I want to say a word in favor of the department of experimental mechanics. A considerable portion of an engineer's work is observing and recording experimental data and then reasoning from it; and the actual doing of things and observing the results of experiments, and then recording these results accurately and reasoning from them, is, I think, an important part of his school training. Moreover, he not only must be able to observe thoroughly and accurately, but he should have some training in reporting the results of those experiments, so as to be able to convey in a definite way the result of his observations, so that somebody reading his reports can see why he makes his statements.

Dr. Harrop (read by Mr. Norris)—The primary question treated in Professor Burgess' paper is as old as the history of education. The process of training that a man undergoes during the early years of his life in an educational institution takes place at a period that precedes in general the breadwinning days of his career, and is supposed to fit him for the major portion of his life which begins the day he leaves school. We have not decided yet whether that training should be entirely devoted to broadening out his mind and teaching him to think on all subjects with celerity and accuracy, or whether it should fit him especially and thoroughly for the pursuit of one calling to the exclusion of what we know as broad culture. I must disagree with the author of the paper that our engineering courses do either of these things well. Less than a century ago the British universities gave their attention solely to cultivating the individual's appetite for literature and philosophic lore. The only professions that it was respectable to pursue were the ministry, the law and, by a generous courtesy, the practice of medicine. The development of scientific research and the demand for educated men who could apply scientific principles to engineering work led one institution after another to offer engineering courses. I forget at the moment whether it was Tyndall or Spencer who balked at the study of Greek, Latin and antiquated speculative philosophy when he wanted to study applied science, bnt, whichever gentleman it was, I remember that he made a noisy protest against the breadth and shallowness of those early engineering courses. The special courses given to-day in the universities of Great Britain are improved from an engineering standpoint, but while the quality of depth has increased, they retain their breadth, and Britons, with a first-class technical education, commonly make use of Latin phrases and classical references that are, as a rule, too much for their cousins on this side. A young man, whose family is identified with the best social life of Washington city, told me not long ago that he had practically ostracised himself by choosing an engineering education and adopting a calling that would require him to work with his hands among mechanics and the like. He was convinced, as his father had warned him in the beginning, that if he ever got far enough in his profession to manage a company or finance a syndicate he might safely go back to his own, but for the immediate future his wisest plan was to confine himself socially to less exclusive circles. We are at liberty to hold any opinion we choose of Washington society, but the fact remains that the character of the education dealt out in our engineering courses does not endow the recipients with all the graces, nor has it the reputation of stamping them broadly and generally with an air of culture. A boy who originally lacked refining influences may take up an engineering course, and if he enters into the college life may learn to wear evening clothes without feeling like a wooden Indian; by associating with students in other lines he may acquire a taste for and a familiarity with art, literature, philosophy and the other varnishments that will

make him acceptable even to the ultra-polite; if time permits he may elect to take work in other courses and acquire a knowledge of much that his engineering course does not prescribe. But such a student is the exception rather than the rule. I think I am safely within bounds when I say that most engineering students are not prepared by their course to express themselves with facility either orally or in writing; that they have not been trained to that poise which enables a man to face a group of his associates, whether there be two or a hundred, with confidence and yet with the ease that gives them to know that he is their equal whoever they may be; and that they lack the familiar acquaintanceship with the best that modern society has to offer, and are "impossible" from the standpoint of the "politely cultured." Now, if existing engineering courses only succeed on the average in producing a very imperfect and inadequate development of the individual in the broad sense, what have they to their credit from a utilitarian point of view? What is the value of their product in dollars and cents? If a man takes a course with the idea of developing his earning power to the uttermost limit in some specific line, he has some expectation that the time spent in school will teach him the things he will need most, when he begins his breadwinning career. His schooling absorbs four years of his life, while another, who has chosen to go to work instead, may have learned in that four years, in the shop or field, a great many things of practical value. I do not wish it to be thought for a second that I believe the schooling should be foregone for the sake of that practical experience. The man who has not had a proper technical education realizes (and so does everyone who has observed him) that he is terribly handicapped; and he cannot get far, or if he does, it is at the expense of weary toil and many disappointments. But when the schooling prevents the acquisition of that practical experience during a period of four years, it is only just that it should repay him in full. The employer's method of running his business is to organize it into a system of coherent details, and then to delegate the details severally to men who can keep them going. The employer supervises the *results*, but he cannot give continuous attention to the operation of each one of his detailed departments. It is up to the employees, in the terse, unpadded language of the day, to deliver the goods. They may have all the culture in the world; they may be able, and often are, to think it all out logically and explain clearly and convincingly why they failed to get the results to him, but it does not require more than one syllogism to arrive at the conclusion that they are not earning their pay. Is the average college graduate fitted by his college course to "make good?" Our paper says: "There are many who hold that the technical educator falls far short of success from the fact that his graduates cannot step at once into the management of works, equipped not only scientifically and theoretically, but with a knowledge of technique, of business details and with ability to handle men. The engineering graduate is not and has never been claimed to be a finished engineer. The purpose towards which the administrations of engineering colleges direct their efforts is to train young men into resourceful and exact thinkers, men with a fundamental knowledge of the laws of nature and the means to utilize nature's forces. In other words, the object is to produce not finished engineers, but young men of capacity for rapidly becoming engineers when thrown into industrial work." When I was in the second year of my mechanical engineering course, a member of the preceding graduating class returned for a visit from his work in Cleveland and said to me confidentially: "A fellow thinks when he graduates that he is an engineer. But he has to get onto his job, and work a year at it. Then he is an engineer." This was somewhat of a disappointment to me, and rather upset my ideas; also the coincidence between the time limit set in this dictum and the twelve months that had elapsed since his graduation made a strong impression on me. I might add that I met him the other day and formed the private opinion that he is not an engineer yet. A good deal depends on the man. Some would succeed without the college training; others fail in spite of it. Perhaps it is well that the average course is too general rather than rigidly special. Very often a student does not know what particular kind of employment he will get until the last year of college; some not even then. He is a very young man as a rule, with ill formed notions and undeveloped perspective, and lacks above everything else a proper estimate of his abilities and bent. The wait gives him a needed respite before committing himself, and in the meantime he is acquiring general knowledge that will allow him to do well in any one of several lines. The first half of widely different engineering courses are usually very much alike, and it is not rare for students to change in mid-course without losing much credit for work done, as they find their ideas taking definite shape. This is as it should be, and offers a suggestion of considerable value. If a man cannot first choose his future occupation and put in two or three years at it before he begins his college course, and then take up the college work with a clear appreciation of the relative value of things he has a chance to learn—if he cannot follow this ideal plan it is surely best that the first years of his course lay the broadest and most general foundation possible, and that the process of specialization continue progressively toward the close. And the closing year should be devoted exclusively to the particular narrow line of work he expects to take up. It is evident that this will result in a multiplicity of courses. I am not clear as to just what Professor Burgess understands by the gas industry. In its widest sense it certainly has to do with everything connected with the production and use of gaseous fuel. But the generation of power from coal through the interposition of the producer, the design and operation of the gas engine, and the general utilization of producer and blast furnace gases, on the one hand, are not vitally connected with the manufacture of coal gas and carburetted water gas in a gas works for city distribution. A training in one of these fields will not necessarily fit a man to succeed in the other, nor in the nature of things will he be often called upon to understand both alike. Producer gas in its most important application is new; the business of supplying city gas is old, and aside from the introduction of labor-saving machinery into works operation has suffered little improvement in recent years. The manufacture of city gas is understood by a few men in each town, while the overwhelming majority of the inhabitants know it only as a set of chandeliers and wall brackets in the house, a meter in the cellar and the collection office down town. I wonder someone has not called it the Hermit Industry. Any technical school that would inaugurate a satisfactory course in gas engineering would be doing a good work, and if the course proved by its fruits to have real merit it is not difficult to believe that it would meet with a cordial reception. But it would be expected of such a course that it do more than simply equip men "with a fundamental knowledge of the laws of nature and the means to utilize nature's forces." It should familiarize them (in the last year if need be) with the features of a gas works, with the problem of costs, with the peculiar genus of man known of the "gas house terrier," with some of the same type of apparatus, with the more important distribution and commercial methods, etc., etc. I judge from the passage first above quoted that Professor Burgess does not believe that a knowledge of how to handle men can be inculcated through a series of lectures, and in that he is surely correct. But almost anyone who has seen a raw foreman disposing a dozen laborers so that every man gets into his neighbor's way, or who has experienced a row with a discontented retort house force, will believe that a few points might be imparted in a single lecture on "How Not to Do It," if the lecturer had been through the mill himself. A satisfactory course in gas manufacture, as mentioned, should include some chemistry, but I think this feature is usually overrated. A thorough knowledge of the fundamental principles of physics, with certain phases carried to an advanced stage, is equally valuable; and a great deal more important to the average gas engineer. Another requirement is a moderately thorough knowledge of the fitter's trade. Still another is certain work that belongs usually in the civil engineering course—foundations, architecture, masonry and structural steel. A course preparing men for gas engine and producer work is much needed, but should be different from the gas manufacture course. The two could be identical up to the end of the second or third year, but should then diverge and allow of the necessary specialization. It would not do in this place to attempt even to suggest the details that would help toward filling up these courses. By all means the courses should be laid out in conjunction with the employers who will utilize the product; they will be found to have a well defined notion of their needs. With the notable exception in Michigan there never has been a course even approximately suitable for men intending to enter any part of the gas field, nor has there been any practical cooperation between the gas interests and the universities. In contributing this paper the University of Wisconsin has taken a welcome step in the right direction.

The President—Professor Burgess' paper is open for discussion. Mr. Gardiner.

Mr. Gardiner—Mr. President, this is a subject in which I am very much interested. In the matter of education I have personally had perhaps a varied experience, and, therefore, may look at it from perhaps an unusual point of view. As a boy I was for a number of years in a boarding school in France. When I came back to America I was at various schools in Boston, and eventually received what finishing touches I got at the Massachusetts Institute of Technology. That gave me a very broad range of system of education. In Europe they draw the distinction between education and instruction. I should

say that in Europe they instructed me. In this country we aim at education. I take it that in educating a man the main thing is not what we teach him, what he learns, but how he learns to think for himself. We may learn all the wisdom in the world, but if we cannot think for ourselves we will be nothing but routine men. I take it that in going into the gas business we go in as employees; we hope to rise to be superintendents; we hope to rise to be managers, to be officials, presidents, owners of companies. Some of us have taken the technical school as a preparation path to that goal. What can the technical school give us? What can we get from the technical school? It is evidently impossible for the technical school to instruct us in all the various matters which we should know in the upward path we hope to follow. The technical school can instruct us in the detail items of suggestions of thought, so to speak, of science, of physics and of allied subjects. It frequently, it seems to me, confines itself too much to instructing us too elaborately in these concrete items or standards of physical science and the physical arts. It seems to me that it overlooks sometimes teaching us how to think for ourselves. Science is so vast to-day that to compress it into a 4-years' course is a problem. Even in a special course on electrical engineering, or chemistry, or mechanical or mining engineering, it is a task to put the rudiments of any one of those branches into a 4-years' course. It seems to me that it would be very much better to teach a man going into a physical business as an engineer the barest rudiments. He will learn a lot afterwards if he is taught to learn for himself. The main thing is to give him an idea what there is to learn in the world, the principles of thought, above all how to think, and then turn him loose with such data and such mental processes and mental equipment that he will be of service to those employing him—that he will be given an opportunity to work. As long as he can earn a living wage, that is all that he needs at first, and then an opportunity to grow, an opportunity to use his own thinking ability. Now, to that end it seems to me that technical education should be both more narrow and broader. It should be specific and detailed in the items of thought, in giving a man the standards of science. It should teach him the accurately scientific methods of thought, its analytic and synthetic methods of thought, it should teach him how to use commonsense. (I have never seen anybody who could teach commonsense.) It should furth r give him a look at the broad thought of the scientists and thinkers of the world in other branches. Pure philosophy is derogatorily criticized to-day, but I believe in philosophy as a mental training. I believe in political economy. At Tech, we had a very interesting course in political economy. We had a course in political history. We had a course in business law. All of these courses were very interesting indeed. They taught one the broader aspects of thought, of work. I would like, if I may take one minute more, to speak especially of political economy. General Walker, former President of Tech, defined political economy as the science of wealth. Now, what are we in business for? What is business? Business is the art of wealth. The technical man has made good. In the arts, in the physical arts, the scientist has made good as a dividend earner. Now, I would like to know why the political economist, the scientist, the man who has the science of wealth at his hand—and it is a pretty exact science in many respects—should not make good in the business world if he uses commonsense? I really would like to call to the attention of the gas fraternity, if I may be so presumptuous, this science of political economy as applied to the public lighting business. If we look at the public lighting business from that point of view, I think we'll get some rather interesting aspects of it. But the main thought which I have in mind in the matter of education is that instruction in things to know is not the point. The main point is to teach us to think for ourselves, so that we may do sound, progressive, original work. (Applause.)

The President—Is there any further discussion?

Mr. Egner—Mr. President, I would like to say a few words on the mutual advantages to be derived through co-operation between engineering schools and those engaged in the gas industry, and shall speak from my own experience. If I wanted to engage a young man for any purpose, I would give one with an education the preference, other things being equal. Of course, engineers like poets we may say are born, not made; and the colleges may have many men in them that will be like the one referred to a while ago, he "Was an engineer not yet." But education or technical training no doubt is of great advantage in developing or bringing out what is in a man; and I can speak from painful experience. My first real education started in this way: The chief engineer of one of the smaller U. S. Naval gunboats, at the end of the war for the Union, before he left the ship, handed me a copy of Greenleaf's "National Arithmetic," saying, "There, Fred, I will give you that to remember me by." From that, you may infer that I was a steamship engineer. I could make the drawings and build every part of a marine engine, and run it first rate; but I found then, the need of that sort of an education which would enable me to go further, and which the public schools cannot give. I took that arithmatic and began at the beginning all over again, and went through it to the end. Every word in that book, from the introductory history of arithmetic, definitions, signs and axioms, notation and numeration, the properties of numbers, involution and evolution, to mensuration and ending with a lot of miscellaneous examples, was carefully studied. Not a single example was passed without not only solution, but understanding the why and how; for I sat as judge on myself, and would not permit a single example to go unsolved before taking up the next. But oh! It was hard work. I had no one to send me to college, but had to earn my living and be on duty for 24 hours each day at that, for every day of each month during the year, excepting a rare day off, once or twice a month; for I was an officer in the Fire Department of the city of New York after receiving an honorable discharge from the U. S. Navy at the termination of the War for the Union. But in that way I got the time to study, though I could not leave the engine house excepting to attend fires, which were sometimes of frequent occurrence. I tried to get along on 3 hours of sleep per day, like one of the ancient Kings of England, one of the Henry's I think, but do not recall just now which one of them; but could not keep it up any more than he; but did get along with 4 hours of rest out of each 24, when there were no alarms to be attended to. After the arithmetic "Davies Elementary" and then the "University Algebra" by the same author were taken in hand and gone through with like the arithmetic, and not a problem was "by-passed;" the study of one naturally making the next more easy, from "John and Charles have 12 apples between them, and each has as many as the other; how many has each?" to Sturm's Theorem and the concluding Appendix. Then followed the Elements of Euclid or plane geometry, trigonometry and the general elements of mechanical philosophy and applied mechanics; partly preceded by, later on interspersing these studies with a study of the undulatory forces, heat, light, electricity and acoustics. Knowing somewhat the difficulties when one has to depend on ones own unaided efforts, I will now say a few words about what education will do for the young gas engineer, though some of my powder has been burned by previous speakers; and I can only refer to some of these things briefly. What practical good is geometry? If I should propose the simple problem that two parallel lines continued indefinitely will never meet, you will all say, "Of course they won't. We all know that." But if you were asked to prove it you might find some difficulty; and still, this is one of the simple theorems which can be proved, hence is not an axiom. It is the same with the 47th proposition of Euclid; wherein the fact is proved that any two legs of any right angled triangle are together longer than the third; which seems to be such a self evident fact, that it has been called the pons asinorum; though authorities differ as to the reason why that appellation was given to this particular theorem. "But what has all that got to do with the gas business," you may ask. I will try and explain We have gymnasiums, where the body is trained physically; while these studies of which I have given but the merest outline are to the mind what athletics are to the body. At the college the student will get that sort of mental training which will afterwards enable him with greater ease and certainty to reason out the need of another condenser; or how to take all the tar out of gas without material reduction in temperature, and other incidental troubles which may have to be overcome from time to time. When I took up the study of chemistry a professor of Columbia College kindly gave me a few pointers, which illustrated the difference of what it meant to study without or with the aid of teachers. Twenty years later, the same Professor, not however recoguizing me as the young man he had helped a little on the way, complimented me greatly by agreeing with me about certain chemical facts then under investigation in a case upon which we were both engaged by the same company. Entering the gas business as a pipe fitter, I was appointed assistant engineer of the works about 3 weeks afterwards; and under divine providence, I think it was mainly due to the education obtained though under such great difficulties, that the appointment was made. I think we can encourage our college by taking their graduates in, if there are such as are willing to begin at the bottom of the ladder; for while the graduate will naturally "catch on" more quickly than the uneducated man (and be a more valuable one afterwards), and his education hence will be of great help to him; to understand the practical side of the gas business one must learn by actual work; and only then will the worker be able by aid of his previous education to perhaps introduce improvements which are worth while. If I may, I would right here

strongly recommend that the student would strive to acquaint himself with the process, methods and apparatus which have been previously used, no matter how long ago; and the reasons why—maybe— they were discarded; before attempting to introduce improvements of his own, which while original so far as his knowledge thereof is concerned, may be deservedly obsolete. And if the educated student will do this, and provided he has a natural aptitude for the gas profession, he may then succeed and make real advances, beginning with where others left off, and not beginning only where others began, and in the end perhaps not get further or even as far as those who have traveled over the same road before him. I think we can not only encourage our colleges, but very materially the young men able to acquire a college education; and you will soon find out if they are of the class that will make engineers, or of that class which will not. I do not want to bring up sad memories, but will name one shining example of what education will do for the young gas engineer. One of our past Presidents, the late George Treadway Thompson. He came to me as a boy, from the Manual Training School of St. Louis, Mo. Brought up in the lap of luxury, yet he never shirked a duty, no matter how disagreeable it might be. And you all know the eminence in the gas profession to to which he attained before his sad untimely end.

The President—If there is no further discussion, I will call upon Prof. Burgess to close.

Prof. Burgess—I am much pleased with all the remarks and criticisms that have been made upon college work. The suggestions cover a wide field; indeed, they cover most of the important topics of discussion which have been up before the Society for the Promotion of Engineering Education, and it would take me a long time even to discuss them briefly. There is the question of specializing. How much shall engineering colleges specialize? There are two extreme views. One is that they shall give culture and the broadening influences that should surround a man, the other is that the student should be taught some definite line of work, so that when he can get out of college he may be enabled to earn a larger salary than would the apprentice. And then there is the intermediate position. I agree with Mr. Forstall that excessive specializing is not right. We should not even specialize to the extent of giving courses in "gas engineering." Chemical engineering is sufficiently broad and sufficiently specialized to include gas industries as well as many others. I would be very much opposed to giving a course to training a man especially to handle gas business, or to manufacture fuel gas or illuminating gas. That would be carrying specialization to excess? On the question of training men to clear thinking, I do not believe there is any other college course given which trains that quality to the extent that an engineering course does. The laboratory work is a modern development in engineering schools, and that work involves a careful observation of certain experimental operations, and recording the results, and drawing conclusions from them, and rendering a report which must be acceptable to the officer in charge of the laboratory. That training is very valuable in producing clear thinkers, although one of the men who discussed the paper claimed that he has yet to find an engineering college graduate—I believe that is what he said—who was a clear thinker and an accurate one. That criticism is right to a certain extent, but I am very confident that those men that he does come in contact with are much clearer thinkers than they would have been had they not gone under the influence of a college training. The question of social standing is one I never heard discussed before. I am much surprised to be told that the engineer has not the social position that other professional men have. I am inclined to disagree with the speaker, though I have no statistics nor any data to back me up in my contention.

The President—I have pleasure in extending the thanks of the Association to you, Prof. Burgess. (Applause.) The next order of business is the

REPORT OF THE MEMORIAL COMMITTEE,

Mr. Wm. McDonald, Chairman. I will ask the gentlemen not to leave the room, because we are going to close the afternoon session immediately after this report.

Albert H. Branch.

Albert H. Branch was born in Orwell, Vt., and moved to Colorado in the early days of the Colorado excitement. He went direct to Leadville and was there in 1878 while that camp was booming and there became a deputy sheriff. From that position he was made Private Secretary to Governor Grant. After his term of office expired, he became connected with the Grant Smelter, of Denver.

In 1884 Mr. Branch was appointed chief post office inspector for the State of Colorado, and remained in this position until 1892, when he became General Manager of the Denver Consolidated Gas Company. Under his management the water gas plant in Denver was installed, and, due to his ability as an engineer, the model works of the Denver Company were laid out.

Mr. Branch remained as head of the Gas Company until its absorption by the Denver Gas and Electric Company. He then went to Beaumont, Tex., and was interested in the development of oil fields there. His next work was at Oklahoma City, Okla., where he reorganized and rebuilt the gas and electric plant, remaining with this Company until it was sold out. Mr. Branch then returned to Denver and engaged actively in the mining business, which he had followed indirectly for many years.

Mr. Branch was a man of very pleasant personality and had a host of friends throughout Colorado. He was a 32d degree Mason, and Past Grand Master of the Grand Lodge of Colorado.

Mr. Branch leaves a widow and two sons.

John H Tuffs.

John H. Tuffs died of apoplexy at his home in Syracuse, N. Y., on the 18th of June last. Deceased was in his 53d year. He came to Syracuse from Clyde, N. Y., at the invitation of Mr. Austin C. Wood, then Superintendent of the Syracuse Gas Light Company. He was employed as a fireman, probably in the fall of 1872. He was of an observing and industrious disposition, and gradually improved his position until he became Superintendent of the works. When the Syracuse Gas Light Company was taken over by its present owners they continued Mr. Tuffs as Superintendent of the gas division of the enterprise. Mr. Tuffs was of an inventive turn of mind, and some of his improvements made in connection with bench firing have met with marked favor. He is survived by his widow and one sister. The funeral services were held at his home in Syracuse on the evening of June 20th, and the remains were subsequently removed to Clyde for interment.

FRANK W. FRUEAUFF,
WILLIAM MCDONALD, } Committee.

The President—You have heard the reading of the report of the Memorial Committee, gentlemen. The usual practice is to refer it to the Secretary, to be incorporated in the proceedings. If there is no objection, it will be so ordered. The session to-morrow morning will be held in the room where the sessions have been held heretofore, and not in this room. It will be more comfortable up there than it has been here this afternoon. We have a large part of the programme remaing for to-morrow morning, and it will be necessary to begin promptly, and to carry the work through with expedition. The next order of business is the banquet this evening at 7 o'clock, as I understand it, instead of 7:30.

Mr. Persons—7:30. Be very prompt at 7:30.

The President—If there is no further business I will declare this afternoon's session adjourned.

THIRD DAY—MORNING SESSION.

The Association reassembled at 10 A.M., President Doty presiding.

The President—The first order of business this morning is the presentation of the paper,

LABOR SAVING MACHINERY FOR MEDIUM SIZED RETORT HOUSES,

by Mr. F. H. Shelton. You have all read the paper, I presume, advance copies having been furnished to you, and in Mr. Shelton's absence this morning I will present an abstract.

It is doubtless a fact that many gas companies of medium size, manufacturing coal gas, would like to get away from the ordinary hand labor and upon a machine charging and discharging basis, but are deterred by the heavy expense usually considered as necessary in so equipping retort houses. Having recently had this question before me in connection with two or three companies of but moderate size, and having worked out an arrangement that seems to me to give a great majority of the advantages desired, and yet without excessive investment, and at a cost permissible for such companies, I would herewith briefly describe such arrangement for the convenience of those interested in the question.

The fundamental steps necessary for doing away with hand labor, getting greater quickness of working and greater capacity per man, may virtually be taken as—

(a) Some mechanical means for lifting the coal to the highest point required in the retort house;

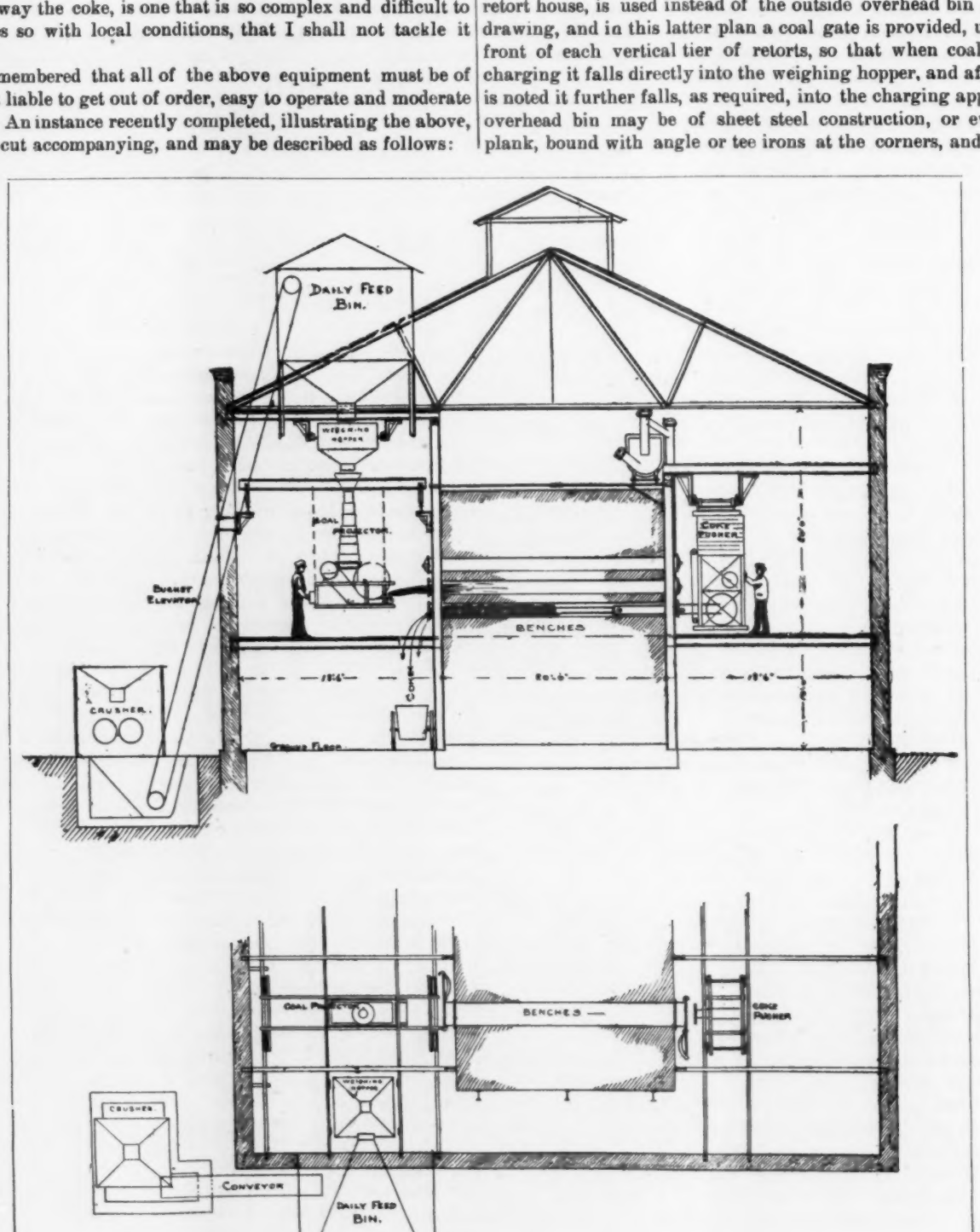
(b) Some convenient and certain method of weighing the coal as it passes into use;

(c) Some form of power machine for putting it into the retorts;

(d) Some form of power machine for pushing the resulting coke out of the retorts.

The question of best form of conveyor, which might be considered as (e), for taking away the coke, is one that is so complex and difficult to solve and varies so with local conditions, that I shall not tackle it herein.

It must be remembered that all of the above equipment must be of simple type, not liable to get out of order, easy to operate and moderate in investment. An instance recently completed, illustrating the above, is shown in the cut accompanying, and may be described as follows:



Wherever the coal may come from, it is brought from the coal stores or incoming cars to the retort house at the ground level, and is dropped through a crusher to take out the large lumps and to make it of best size for whatever charging machine may be used. An ordinary and simple bucket elevator lifts the coal from the boot of the crusher to an overhead bin carried on a trestle support outside of and against the gable end of the retort house. This bin is figured to hold enough for 24 hours' supply, so that, being refilled towards dark, there is no occasion to handle coal in the yard nor operate the conveyor during the night shift. This capacity also enables adjustment and repairs to be easily made to the conveyor, if need be, between its working periods. This bin at the roof level may be called the "daily feed bin." In the instance shown the coal falls from it by gravity through a chute into the inside of the retort house and enters the weighing hopper. This hopper holds enough to charge 3 retorts without refilling, and after being loaded is pushed opposite the retorts that are to be charged. In this arrangement, therefore, the weighing hopper travels back and forth, shuttlecock fashion, as it requires more coal.

In another arrangement a continuous bin, running the length of the retort house, is used instead of the outside overhead bin shown in the drawing, and in this latter plan a coal gate is provided, underneath in front of each vertical tier of retorts, so that when coal is drawn for charging it falls directly into the weighing hopper, and after the weight is noted it further falls, as required, into the charging apparatus. The overhead bin may be of sheet steel construction, or even of 2-inch plank, bound with angle or tee irons at the corners, and tongued and grooved to prevent dust leakage. The discharge chute, however, should be of steel in either case. The weight of the overhead bins is easily carried by extending the bench buckstays and throwing I-beams across to the retort house wall.

The continuous bin form, preferably, should be outside of and just above the roof, the chutes passing through, as it can easily be protected from the weather by a light canopy above, and is far more accessible and convenient to get at by walking along on the roof than by having to get at it under the roof if crowded in the dark and dusty space in the trusses. This, moreover, leaves the full height from ground to truss line unencumbered and free for the weighing and charging apparatus.

The weighing hopper is a special design, built to order, to hold any ordinary quantity desired. It is of sheet steel, mounted on the necessary platform scale weighing apparatus, mounted in turn on a track, and should be provided with gate underneath to control the flow of coal. The scale beam, in the instance I have used, is carried down on a light

framework so as to be opposite the head level of the operator, to easily enable accurate weighing. This beam, moreover, is so made in triplicate form that weights can be set at desired points, so that when the proper amount of coal has fallen out, in charging one retort, the beam will "kick up," as a signal to the operator to shut off the coal until the next retort is in readiness for charging. This weighing hopper is supported on tracks on the under side of the same I-beams that carry the overhead bin.

The charging apparatus shown is of the De Brouwer projector type, but may, of course, be of any pattern desired in such class of apparatus, and I believe there are now 4 or 5 different makes available. Whatever the pattern, it should preferably be carried on an overhead travelling carriage running on rails, mounted on brackets on the wall of the retort house, and on the buckstays, thus avoiding floor rails or any trucks resting on the floor. Floor tracks are bad, as they catch dirt, cause tripping, rust from water, are more apt to get out of line and require stronger floor beams.

The discharging apparatus in the instance shown consists of a telescopic ram carried in a traveling frame mounted on a truck running in channel irons that form a track the length of the retort house, suspended on the under side of I-beams reaching from the rear buckstays to the retort house rear wall. Incidentally, these I-beams make a very convenient platform base for getting at the standpipes and the hydraulic main, and for hoisting mouthpieces, etc. The coke pusher or ram, of course, is so constructed as to be easily moved from bench to bench, or up and down in a vertical plane, according to which level or retort it is to be pushed. It is so constructed as to be adjustable for variations in the retort levels, or for different cross sections, and yet can be quickly clamped at any point at which it is desired to operate it. It, the coal projector and the weighing hopper, should all be provided with ball or Hyatt roller bearing, so as to minimize friction in travelling up and down the retort house, as well as with a chain pull and compound gear, making it easy for a man to propel these parts instead of requiring two or three men to push by sheer muscular effort. All equipment as above should be operated by electric motors, as by far the most convenient form of power. The coke ram requires 2-horse power, the coal projector 5, and the coal bucket elevator and crusher perhaps 5 or 10-horse power. All of these motors, however, are used only intermittently, and the cost of current is very small. I have inclined towards the installation of a small steam turbine-driven electric generator for such work, for while the consumption of steam is not economical under such circumstances, it is one of the forms of electric generators that can be looked after by an ordinary gas house fireman with but little attention, and has but little chance of getting out of order as contrasted with the high speed, delicate, reciprocating engines. The cost of the steam used, using breeze for the intermittent work, I have not determined in such a plant, but cannot believe that it can amount to much.

With an equipment as above, I expect a crew of 2 men to a shift, to operate several times as many benches as could possibly be covered by hand labor, and in that way get the return on the cost of the machinery involved. In addition, I figure an increased operating efficiency from the shorter period in which the retorts are open, more uniform heats, less wear and tear and repairs on the retorts and less breeze in the coke. The time of charging after the machine is centered and the lid is opened on a 10-foot retort is something like 10 seconds, and the time of pushing out the coke and withdrawing the ram is 30 or 40 seconds. With current coming from the engine room so that the machines can be dependably operated, and with coal brought to the foot of the chain bucket lift by the outside force, the retort house men, with such equipment as shown, should have great ease of work and capacity per man, and virtually none of the old laborious retort house labor, excepting the quenching of the coke and the attendance on the furnace fires.

The arrangement shown in the cut is for 20-foot retorts, which can be equally well charged and discharged as the 10-foot length above described. The space required for the charging machine should be 16 to 18 feet, while the coke ram should have from 10 to 15 feet, according to the retort length and the length of the telescopic ram sections. In other words, for benches with 10-foot retorts, the retort house should be about 35 to 38 feet wide inside, while for 20-foot retorts it should be from 55 to 60 feet. It will be noted that 20 feet vertical height from the upper or operating stage floor to the roof trusses is sufficient, and that 10 feet to the ground level, giving plenty of space for coke handling below, yet only involves a building 30 feet to the truss line, which is very reasonable for a machine operated retort house, with full depth benches, etc. As an approximate figure of the cost of such equipment, I would say that in one instance, with 20-foot "through" retorts, and 4 benches of same, the cost of the construction outside of the benches, or the coal handling up to the crusher, and the coke handling after quenching, was approximately $12,500; and in another instance, having 8 benches with 10-foot retorts, the benches being set in line, and with a continuous steel hopper in the roof and a somewhat extensive system of conveyors to take coal from beneath the railroad trestle, within a coal shed perhaps 20 feet away and parallel to the retort house, was about $15,000.

The above is not offered as being justified for very small works, nor as being the best necessarily for a large, or for all types of coal gas plants, but as one specific way of getting upon a machine basis for works of what may be called the intermediate size. I believe it to be well worthy of consideration, and I trust that it will be of interest.

Discussion.

The President—The paper is now open for discussion. We have a contribution from Mr. Carl H. Graf, of Indianapolis.

Mr. Graf (read by the President)—There would seem to be no reason in my mind why the layout and machinery proposed by Mr. Shelton in his paper should not be successfully applied to a medium sized retort house. I do not know whether Mr. Shelton has in operation a plant laid out on the lines shown in the plan, but if he has not I would certainly advise that he place both the coke pusher and the coal projector on the same side of the retort house. Actual working with the De Brouwer projector shows that when a through retort is being charged the flame will shoot out of the other end to a distance of 10 to 12 feet, making it impossible for any work to be done in the vicinity of the retort that is being charged. With both machines on the same side of the retort house this objection is overcome. We have at Indianapolis a retort house containing 8 benches of 9 each through retorts, 20 feet long; both the charging and discharging machines are of the De Brouwer make and were imported from France. Our coal is handled entirely by the belt conveyor system, which takes the coal directly from the railway cars into an overhead hopper in the retort house or into the coal storage shed. The coke is removed by means of the De Brouwer coke conveyor. All the apparatus in connection with the handling of the coal and coke and the charging and discharging of the retorts is run by electric power, there being individual motors on each piece of machinery. Mr. Shelton makes the statement that "the coke ram requires 2-horse power; the coal projector 5, the coal bucket, elevator and crusher perhaps 5 to 10-horse power." As we have individual motors on each piece of machinery it was very simple to obtain tests of the actual power required for the different pieces of apparatus. These tests show that our coal conveyor, handling at the rate of 30 tons of coal per hour, requires 10-horse power; our coke conveyor running under an average condition, which would be with about 1½ tons in the conveyor, takes 6.1-horse power; the discharger or pusher takes 6-horse power and the charger or projector takes 2.7-horse power. The charges in this case were 850 pounds to a 20-foot retort. A test of the total load, made by taking half hourly readings of the volt meter and the ammeter on the generator, showed that the average load for the 24 hours was 14.9-horse power, while the maximum load was 31-horse power and the minimum load 2.3-horse power. This, as stated above, is the total power required by all the machinery used in connection with the retort house. In regard to the cost of the apparatus would state that our cost was considerably higher than that mentioned in this paper, but from information I have received I think that the installations could be made for the figures mentioned by Mr. Shelton. I am afraid that Mr. Shelton will find that the labor item will be more than he anticipates. We expected to run our retort house with a full complement of 18 men, but we find that the best we can do at the present time is 25 men, which would be an average of twelve 10-foot retorts per man for 12 hours.

The President—We have a contribution from Mr. B. O. Tippy, of Detroit, which I will ask the Secretary to read,

Mr. Tippy (read by the Secrstary)—From my experience with drawing and charging machinery I should say that many medium size retort houses at present operated by hand labor could profitably change to a machine charging and discharging basis. This would at the same time lessen the chances of labor trouble. In Mr. Shelton's paper he confines his attention to installations of through retorts. Many plants are equipped with retorts having backs in them. Such installations are successfully operated by drawing and charging machinery. As one specific method of accomplishing this I would suggest the following: A Bronder combination drawing and charging machine, in which the drawing rakes, charging scoops, and coal bin are all on one bedplate and are operated by one man. The machine is to be connected to a steam pipe trolley which utilizes steam generated in the boiler house.

The coal is to be loaded into cars and elevated by a direct hydraulic or direct steam coke elevator, with which most plants of this size are equipped, and dumped on heavy grates over the retort house coal bins, the lumps which would not fall through the grate to be broken by hammer. The coal could be weighed in the cars before being dumped into the bin, or the charging machine with its supply of coal could be weighed on track scales. Such an installation in a plant, say of 8 benches of 6's in one row, would cost, including a coal bin of 24 hours' capacity, and utilizing a coke elevator already in, about $11,000. If an elevator were necessary, it could also be used for handling the coke and would cost about $2,000. An entire new concrete charging floor if required would cost about $1,600. The distance from the brickwork of benches to retort house wall should be 21 feet, although a shorter distance could be made to do. About two-thirds of the above cost is in the charging machine and its accessories, the coal handling and crushing machinery, the overhead bin and the extra strength of floor required; on the other hand more than half of the saving in labor is made by the use of the drawing machine. A drawing machine only, such as the Foulis, for instance, can be installed for approximately $4,000. They can be installed in plants too small to afford both; indeed, a plant can be very economically operated in this way.

Mr. Egner—Mr. President, I am sorry that Mr. Shelton is not in the room. He was here, but I do not see him now, and for that reason I feel obliged to pass over a few questions which I would like to have asked him in connection with his paper now under discussion. I hold, to begin with, that horizontal retorts, as we have known them for many years in gas manufacture, are now or ought to be obsolete in the light of the well authenticated improvements made in coal gas manufacture of recent years, the results of which are quite fully described in the gas journals of the past year, as anybody making a study of the subject can find out. I refer now to the standing retort system, not the misnamed "vertical 8's," which first came into notice by means of a paper read at a meeting of the American Gas Light Association some years ago, in which we were told "Why Milwaukee Didn't Build Inclines." These standing retorts have come to the front very quickly. They have been thoroughly tried at Dessau and at the Mariendorf works, near Berlin, in Germany, with the result a number of works are about to be supplied with that system, among which is the works at Cologne, where 24 benches of such retorts are being erected under contract to be ready for use early in the present year. The reasons why the horizontal retort should be considered obsolete may in part be understood when you reflect upon the effect of the clear space between the layer of coal or coke in such a retort and the retort roof, and the effect this has on the ammonia production, or we should say "destruction;" and the thick pitchy tar in the hydraulic mains, when the usual high heats are maintained. There can be no doubt but what the claim made by those who have tried the standing retort that they get about double the quantity of ammonia; not thick, pitchy, but thin tar; just as much and more gas, and as much and better coke from like coal, are well founded, and hence these are to be seriously considered; more so than stoking machinery for a system which had better be abandoned, the sooner the better. But if you do not care to consider things which we do not yet have in this country, let us come back to the inclined retorts of which there are now certainly a number of installations in operation in various sections of this country. Mr. Shelton writes of "some form of power machinery for putting it (the coal) into the retorts," and "some form of power machine for pushing the resulting coke out of the retorts." That is all very good if you are going to shut your eyes to the progress of the age and are going to continue the use of the old-fashioned retorts; and continue on satisfied with losing half of one of your most valuable by-products, ammonia, and to keep on with the hydraulic main tar pitch factory, and then the projector and "angle worm" pusher may be the best thing. But even then they cannot be used in the majority of the works in our country, but only those of considerable magnitude. Coming to the cost, Mr. Shelton's figures for the kind of apparatus which he advocates give it as $3,100 per bench. Why not put in the inclined retort system and let nature's force do the greater part of the work? I have recently designed and built a very small gas works for the city of Fredericksburg, Va. There are only 2 benches of 4's, while but 1 is needed, and which is served by 1 man per shift up to 12,000 pounds of coal per 24 hours. The cost of the charging apparatus is $250 per bench, and the apparatus could easily supply 4 or even 6 benches, instead of only 2 of them. The coal scales are included in the cost of apparatus given. The whole apparatus is exceedingly simple. An ordinary coal wagon is used for charging the retorts. It is filled in the yard; after being weighed is pushed on to a hydraulic elevator, such as is used in the Lowe improved water gas apparatus, raised to the charging floor and the coal dumped into the retorts. The distribution takes care of itself, and could not be improved upon by any method whatever. The upper retorts are charged with the same wagon; only in their case the elevator is allowed to come up about 2 feet higher. The wagon is rolled on to a small truck, which is then rolled into position and the coal dumped as before. Anybody could do it. No skill is required, and, as I said, the distribution is simply perfect, if care has been taken to break the two large lumps in the coal. Slack will go in all right. The retorts are 10 feet long on the slope, and can carbonize 600 pounds of coal in 4 hours per retort; though as there is no demand for all the gas that could be made, the charges are either reduced or let run longer during this season of the year. The retort house is only 28 feet wide inside and 22 feet high from top of ashpan of the recuperator furnaces to the wall plate upon which the iron truss of the roof rests. The charging floor is 10 feet wide, and ample, while in front of the bench, the discharging side, we have only 7 feet 10 inches; but which is also ample by reason of a device of my own which is not patented. This consists of swinging doors in front of each bench. These doors when opened form a shed of about 10 feet in length in front of each bench, and thus increase the size of the retort house for the time being, just when required only. This device materially decreases the cost of the building and answers every purpose—useful purpose—I should have said. I should like to say a few more words on other parts of Mr. Shelton's paper, and am sorry he is not present; but I hope that in what I have said there will be found some food for thought.

The President—Any further discussion? Mr. Carpenter, do you want to say something on Mr. Shelton's paper?

Mr. Carpenter—I think not, Mr. President.

The President—Is there any further discussion? Will you close the discussion, Mr. Miller, for Mr. Shelton, in Mr. Shelton's absence?

Mr. T. D. Miller—Mr. President, I am in such a frame of mind in regard to coal gas plant of modern design that I am not ready to say anything. I am working over it, praying over it. I know that the little plant of Lynchburg, Va., contrary to Mr. Bredel's statements in his paper, has 2 benches of 6 retorts, inclined, operating on an outside generator. and the manager seems to be very well satisfied with the results being obtained there. His experience is, as Mr. Bredel says, that the fuel economy is not quite as great as it would be if the benches contained their own furnaces, but there are many other features of advantage to it. One of them is the nicety with which the heat can be regulated and maintained by means of the valve. Another is the fact that the furnace doors are not being opened at regular intervals for clinkering purposes, and constant cooling off of the bench, and expansion and contraction of the retort, resulting in its eventual disintegration. The thing that makes the horizontal retort desirable now that we have the projector and pusher to go with it, is the fact that we don't have to build such a tall stack. You get down closer to the ground, in fact, you can operate that with just a pit, and you have direct fired benches. I mean by that a generator in the bench, with inclines or verticals, means a lot of overhead construction, which is always expensive to build, and my experience is it is expensive to maintain. I think that is the reason Mr. Shelton has apparently taken so kindly to the through retort with a simple projector of some character to put the coal in and push it out. I understand that the pushers are working with eminent satisfaction where the coal has been properly put in. Practically no difficulties arise at all from their use.

The President—The thanks of the Association are extended to Mr. Shelton for his paper.

(To be Continued.)

[Prepared for the JOURNAL.]

Using Gas Pipes for Carrying Wires.

By MR. GEORGE D. RICE.

Gas men are often called upon to arrange gas pipes of buildings to receive wires for electrical lights. The operation of shaping gas pipes to accommodate the requirements of the modern electrical light wires is simple, providing that the necessary apparatus be employed. We cannot expect to run the wire through a pipe from floor to floor without encountering some barriers. There are turns, elbows, tees, small unions, and various obstructions. New men are apt to think that the only thing to do is to push the line of wire through the hollow of the pipe as in Fig. 1 at *A*. So long as the pipe is straight no trouble is experienced. The wire being properly insulated, no harm follows in case the wire comes into contact with the metal wall of the interior. Sometimes the wire must make a turn in the pipe as in Fig. 2 and then again

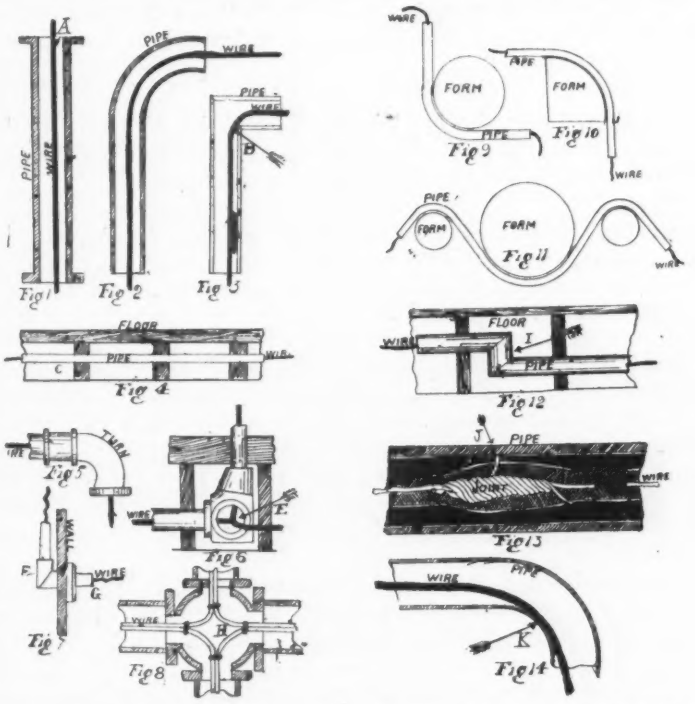
we find that there is a square angle to pass, as at *B*, Fig. 3. The vibrations of the wire on the sharp edge of the metal at *B* often wear into the insulation and cause trouble. Some men remove the elbows of this pattern and substitute curved turns as in Fig. 2. When the wire is run along the floor line, the pipe is penetrated as at *C*, Fig. 4, and the wire is permitted to lay as it will inside. There are numerous devices in the form of disks and brackets for affording supports for the wire inside the pipe. But these contrivances are not popular except in pipes of large diameter. There may be difficulty in stringing the lines of wire through places between partitions and floors. But push rods and long wire hooks can be used to help in this work. Fig. 5 illustrates the design of turn usually put on for the wire. In this turn, the wire can adjust itself very readily on a smooth surface in which there is no sharp shoulder to abrase the insulation of the wire and create "grounds" and other troubles. In Fig. 6 is shown the kind of union sometimes employed when it is necessary to get branches from the wire main. The wires meet in the center of the union as at *E* and are taken off in the different directions as required. This adjustment is arranged between the walls or floors as is most convenient. In Fig. 7 is a form of connection for the wire as applied in using a common gas jet. The wire is shown as it enters the gas pipe inside the wall at *G*. The wire passes through the pipe and makes the elbow by bending at *F*. Then the wire is drawn out at the extremity and is connected as required to the fixture carrying the electrical lights. Some odd combinations are very often necessary in order to get needed adjustments for electrical light fixtures. In one case it was necessary to make a 4-lead center as illustrated in Fig. 8, using the middle union of a gas pipe which was located between the walls.

The wires were drawn up from the four different directions, and then all were centered as at *H*, with an insulated binding. From this point the four branches were readily taken to the terminus. In some buildings wood is used in unison with metal pipes for carrying wires. The metal pipe makes an effective means of conveying the wires, and in the event of the pipe being already in place, a great amount of tearing out of partitions is avoided in putting in wires for electrical lighting. Of course, many pipes have to be bent in order to make them suitable to the new conditions. Therefore the forms shown in Figs. 9, 10 and 11 are employed. Any gas man may readily construct several forms of this order from hard wood and arrange the same for use in modelling pipes to certain patterns. The forms are supported on hard wood frames.

Very many of the pipes can be bent cold. The usual practice of preventing the wall of the pipe from collapsing consists in plugging the interior with molten rosin. When you undertake to put electrical wires through gas pipes you may expect tribulations to arise which were not expected. You may get your wire started in good form along a line of pipe between floors and suddenly the wire refuses to go any more. You work at it for an hour or more without avail, and finally tear up the floor boards over the clogged point and discover a useless sharp turn in the line of pipe, as illustrated at *I*, Fig. 12. Then you have to remove more floor boards and take out a section of the pipe, and either get the wire by the obstruction or put in a new section, omitting the unnecessary elbow.

Gas men must get used to annoyances of this order when changing from the gas light to the electrical light or *vice versa*. It not infrequently occurs that the electrical lighting wires are removed and gas restored. Hence the gas man must be ready for both kinds of service. Only the other day a party using electrical light had his current cut off and gas replaced because the electrical company had joined their volt meter for testing on the inside of the house meter, thus making the bill $2.50 more that month for current used during the two weeks' test. The electrical light company refused to deduct the amount from the bill. Another party had opened the switch in his house and used oil lamps for a month and his bill came in for electrical light just the same and he ordered the electrical lighting fixtures out of his house. And so it goes. Then there are inspectors to make things interesting and it is a good thing that they do. One man in putting wire through a pipe made a joint like that in Fig. 13 inside the pipe and a piece of the copper wire was left exposed as at *J* and this in time contacted with the pipe.

The current made the pipe heat and char the wood and no doubt a fire would have resulted in time. In another case a heavy insulated copper wire was so arranged that the vibrations against the surface of the pipe inside caused the insulation to wear from the wire and also produce thinness in the pipe wall. In course of time the wall was worn so thin that had the defect not been detected, an opening would have been made and in the event of an exposed wire, surrounding



woodwork might have been ignited. Considerable care is needed when planning the use of gas pipes for electrical wires. I know of cases in which errors have resulted in serious consequences. The fire insurance inspectors are usually very careful about inspecting the arrangement of wires in pipes and often locate danger points, which as a rule, can be rectified without tearing out much of the work.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Camp Hill, Pa., borough council has received the acceptance of the ordinance recently passed by it to give a franchise to the Camp Hill Illuminating Gas Company, in which a number of Harrisburgers are interested. It is thought that the gas will be furnished in another twelvemonth.

THE McDonald Meter Company, of Albany, N. Y., has decided to build a new plant on Lancaster avenue, the old one having become too small to properly take care of their present and rapidly growing business. The building will be 150 by 206 feet deep and 4 stories high, and a piece of land 150 feet square adjoining it is secured for future extensions—the number of employees will be increased from 400 to 600. The boiler room is a separate building 60 feet by 80 feet.

FIRE destroyed the buildings and machinery of the Yakima (Wash.) Gas Company on July 10th. The fire broke out in the retort house and was beyond control before the department could reach the scene. The loss cannot be accurately estimated. It will depend on the condition of the machinery. It may reach $25,000 or may be no more than $7,000 or $8,000. There was no insurance. The plant had just been completed and gas turned into the mains for the first time on the date of the fire.

MR. DOUGLASS CLERK, of London, England, the great expert on gas engines, is in this country. Mr. Clerk was retained in January, 1904, by the Electric Vehicle Campany, of Hartford, Conn., as an expert in its suit against the Ford Motor Company, which suit involves the validity of the Selden patent.

MESSRS. H. HENDERSON, of New York city; Richard R. Young, of Passaic, N. J., and E. C. Roberts, of Hoboken, N. J., representing New York capitalists, are investigating the Dover (N. H.) Gas Company, with a view to purchasing it.

MR. FRED. CARBONI, superintendent of the gas plants in the city of Mexico, has died at the American hospital from pneumonia, and the remains will be shipped to Salt Lake City for interment.

THE Auburn, N. Y., gas rate has been finally fixed at $1.13 per 1,000.

MANAGER S. E. LINTON, JR., of Savannah, Ga., will take charge of the Vicksburg (Miss.) Gas Company's affairs August 1, succeeding Manager George B. Bains.

MR. F. K. LANE who has been Manager of the Altoona (Pa.) Gas Company since Mr. Harper's resignation, goes to Richmond, Ind., to fill a like position there for the same group of companies.

THE Dominion District Steam Heating Company, Toronto, has been incorporated with a capital of $100,000, to manufacture gas, electricity, etc. The provisional Directors include W. Seccombe, G. E. Bradshaw and H. L. Dunn, Toronto.

SENATOR PETTIGREW proposes to have a company of citizens procure a franchise to operate a gas plant and then buy the property of the Sioux Falls (S. D.) Gas Company, operate it, but sell gas at a reduction of $1 per 1,000, until the profits reimburse the stockholders for their investment, with a just per cent., and then turn it over to the city free of charge. The price of gas in the city is $1.60 per 1,000 feet. The Senator has quite a little to learn about the gas business.

THE assessment of the San Antonio (Tex.) Gas and Electric Company was raised by the County Board of Equalization from $314,730 for 1905 to $356,900. This makes a total increase of $42,170.

THERE were 500 dogs at the end of the parade furnished by the circus at Pueblo, Col., recently. These dogs were led by 500 boys and on each canine was a blanket on which was painted "Cook with Gas." Colorado seems to be daft on dogs for parades. Denver used this dodge about a year ago.

MR. E. C. BEACH has resigned his position as General Manager of the Gas Company at East St. Louis, Mo., and has gone to Little Rock, Ark., to fill Mr. W. A. Aldrich's position, who has also just resigned.

AT a meeting of the stockholders of the Leominster (Mass.) Gas Light Company it was voted to merge with the Boston Heat, Light and Power Company. The latter already controls several lighting companies in that vicinity.

THE New York State Commission of Gas and Electricity has under consideration an application of the Poughkeepsie Light, Heat and Power Company for permission to issue bonds to the amount of $150,000 for extension of its plant.

AT a recent meeting of the Business Men's Associotion, of Danbury, Conn., Charles H. Merritt, President of the Danbury Company, admitted that the rate was about $3.15 per 1,000 feet, but he said that the gas was of a superior kind and burned enough longer than ordinary coal gas to make it worth the price, being 35-candle power. Danbury thinks that even if the gas is 35-eandle power the price is excessive when compared with the average price in other cities for gas that is 16-candle power. The Mayor has asked the State for the services of a gas inspector, as provided by the statutes, to go to Danbury and make an investigation of the gas supply of the city, its cost and quality.

WILMINGTON, DEL., granted a franchise to the Commercial Light and Power Company to engage in the gas and electric light business. The Company was opposed by the old Electric Light Company, which has been doing business in the city for a number of years; the new Wilmington Light, Power and Telephone Company, in which many Wilmington capitalists are interested, and by the old Gas Company, which is owned by John and James Dobson, of Philadelphia. The measure will now go to Mayor Wilson for his approval. In order to get the franchise, the Company offered to give the city $50,000 within 1 year and 3 per cent. of the gross receipts on the electrical portion of the business, in addition to selling the city gas at 75 cents per 1,000 cubic feet, the consumers gas at 90 cents, and furnish city arc lights at $40 a year each.

MR. H. C. ABELL succeeds Mr. Wm. B. Tuttle as Manager of the Consolidated Gas Company, of New Jersey, at Long Branch, N. J. We believe, however, this is only temporary.

AT a meeting of the Council of Carpentersville Ills., the Western United Gas and Electric Company was granted for a consideration of 350,000 feet of free gas a year, a 50-year franchise. The Company must commence work within 30 days and lay 2 miles of pipe within three months.

AMENDMENTS to the Thomas McCusker gas franchise were passed by the Portland, Ore., Council which are intended to make binding the forfeiture of the $50,000 bond required by the ordinance in case a plant is not installed and mains are not laid by the grantee. The amendment was passed with only one dissenting vote. The McCusker ordinance has already passed to official publication and the changes made will necessitate another publication with the changes incorporated. The Colson gas franchise, which had not yet been published, was amended to conform with the changes in the McCusker ordinance, and it was also ordered published.

THE Racine (Wis.) Gas Light Company is preparing to go ahead with the work of laying the pipe line from there to Kenosha, where the residents henceforth will be furnished with Racine gas.

THE Central Kentucky Natural Gas Company have in contemplation the extension at an early date of their pipe line from Pine Grove in Clark county to Paris, Ky., a distance of 13 miles.

THE Belmont Gas Company, of Belmont, N. Y., was incorporated with a capital stock of $200,000: Directors, James D. Russell, Archie F. Russell, Lakewood, N. Y., Earl Ackerman, Friendship, N. Y.

THE American Light and Traction Company has declared a dividend of 1½ per cent. on the preferred stock and 1¼ per cent. on the common stock for the quarter ended June 30. Dividends are payable Aug. 1.; books close July 21 and open Aug. 1. This represents an increase of ¼ per cent. on the common stock over the last quarter. The net earnings for the six months ended June 30, 1906, were $1,023,535.

MR. JOHN HOARIE, a prominent contractor of New York, died at his home in Elmhurst, L. I. Mr. Hoarie was for many years superintendent of the Equitable Gas and Electric Company, of Utica, N. Y.

THE Delaware Coke and Gas Company posted notices at Wilmington that it would ask for a franchise to engage in the gas and electric lighting business.

A COMPANY has been organized with a capital of $150,000 to supply Iron Mountain, Mich., with gas. The main office of the Company will be in Detroit, and the following officers and directors have been elected: President, William G. MacIntosh; Vice-president, Henry M. Wallace; Treasurer, John P. Glendon; Secretary, Alfred W. Glass. Glendon and Glass are both of Detroit. The officers, with Senator Andrew Fyfe, constitute the Board of Directors.

ON his retirement from Sonth Bend, Ind.. to go to Altoona, Pa., several of the South Bend gas departments presented Mr. Perkins with handsome mementos of the occasion.

PHILADELPHIA capitalists have organized the Ashland (Va.) Gas, Water and Sewerage Company, and secured the franchise right from the town to install a plant and begin operations. The capital stock of the Company is $100,000, which is considered ample for present needs and some future growth. Mr. J. F. Howison is one of the moving spirits in the enterprise.

THE Peoples Gas Company, of Spokane, Wash., now controlled by Eastern parties, has secured a plot of ground on Cataldo avenue, between Columbus and Superior streets, for the new gas plant. The site for the buildings is close to the O. R. & N., the Great Northern and the International Roads. The buildings to be erected by the Company will cost in the neighborhood of $50,000. A holder with 200,000 cubic feet capacity will be erected at once.

THE Suburban Gas and Electric Company has been authorized by the gas commissioners to issue 1,125 shares of additional stock at $120 per share. The proceeds thereof are to be used to provide for floating indebtedness and to pay for recent additions to the property.

THE management of the Massachusetts Gas Companies, of Boston, expects to realize approximately $1,500,000 in cash from the sale of its unused properties during the current year. The money obtained from this source will be used for the payment of improvements made during the past year and those now in progress.

THE AMERICAN GAS LIGHT JOURNAL

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, AUGUST 6, 1906

The Market for Gas Securities.

Peoples gas, of Chicago, declared a regular quarterly dividend of 1¼ per cent., payable August 25th. Books close August 13th and open August 27th. The regular meeting of the Directors of the Consolidated Gas Company, of New York, which was to have been held on August 2d, for the payment of dividends, was indefinitely postponed on account of the absence of several of the Directors on their vacations. The meeting is awaited with interest. The Brooklyn Union Gas Company has sent a circular to stockholders which says: "The Board of Directors has decided that the interests of the shareholders will be served by a discontinuance of quarterly dividends, and consequently no dividend will be paid on the 1st of next September."

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

AUGUST 6.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	137	137½
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	3,000,000	1,000	101	104
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	..	105
Mutual	3,500,000	100	225	250
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	103	105
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	98	104
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	101	103
New York and East River—				
1st 5's, due 1941, J. & J.	3,500,000	1,000	108	111
Con. 5's, due 1945, J. & J.	1,500,000	..	104	110
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	155	175
1st Mtg. 5's due 1930, M. & N.	1,500,000	1,000	104	108
The Brooklyn Union	15,000,000	1,000	110	130
1st Con. 5's, due 1948, M. & N.	15,000,000		.	..
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Bay State	50,000,000	50	5/16	¾
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47⅛	50
Buffalo City Gas Co.	5,500,000	100	9	10
" " Bonds, 5's	5,280,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106¾
Cincinnati Gas and Electric Co.	29,500,000	100	103⅛	103¾
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	..	95
Preferred	3,026,500	100	107⅛	108
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	.	89
Mortgage, 6's	3,600,000		..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	119
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98⅛	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104⅛	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
" Bonds, 5's	10,500,000	..	107⅛	108⅛
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104⅛	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	105
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Massachusetts Gas Companies of Boston	25,000,000	100	58⅛	59
Preferred	25,000,000	100	88¼	88⅛
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	6,000,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	91¾	92
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104⅛	105⅛
San Francisco, Cal.	15,800,000	100	..	..
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112⅛	115
General Mortgage, 5's	2,465,000	1,000	96¼	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,600,000	20	300⅝	301
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600,000	50	230	..

Advertisers' Index.

GAS ENGINEERS. Page

A. E. Boardman, New York City 237
Baxter & Young, Detroit, Mich 255
B. E. Chollar, St. Louis, Mo 248
Cruse-Kemper Co., Philadelphia, Pa 244
David Leavitt Hough, New York City 245
Davis & Farnum Mfg. Co., Waltham, Mass 256
Economical Gas Apparatus Construc'n Co., Toronto, Ont 237
Frank D. Moses, Trenton, N. J 256
Fred. Bredel Co., Milwaukee, Wis 254
Frederic Egner, Washington, D. C 260
H. M. Byllesby & Co., Chicago, Ills 243
Humphreys & Glasgow, New York City 257
Isbell-Porter Co., Newark, N. J 244
J. F. W. Jost, Philadelphia, Pa 245
Kerr Murray Mfg. Co., Fort Wayne, Ind 256
The Gas Machinery Co., Cleveland, O 240
The Jeffrey Manufacturing Co., Columbus, O 254
United Gas Improvement Co., Philadelphia, Pa 251
Western Gas Construction Co., Fort Wayne, Ind 264

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, New York City 237
Bartlett, Hayward & Co., Baltimore, Md 257
Baxter & Young, Detroit, Mich 255
Connelly Iron Sponge & Governor Co., New York City 253
Continental Iron Works, Brooklyn, N. Y 258
Cruse-Kemper Co., Philadelphia, Pa 244
Davis and Farnum Mfg. Co., Waltham, Mass 256
Deily & Fowler, Philadelphia, Pa 260
Economical Gas Apparatus Construc'n Co., Toronto, Ont 237
Frank D. Moses, Trenton, N. J 256
Fred. Bredel Co., Milwaukee, Wis 254
G. Shepard Page's Sons, New York City 255
Humphreys & Glasgow, New York City 257
Isbell-Porter Company, New York City 244
Kerr Murray Mfg. Co., Fort Wayne, Ind 256
Lloyd Construction Co., Detroit, Mich 246
Logan Iron Works, Brooklyn, N. Y 260
Quintard Iron Works, New York City 257
R. D. Wood & Co., Philadelphia, Pa 258
Riter-Conley Mfg. Co., Pittsburgh, Pa 259
Stacey Mfg. Co., Cincinnati, O 259
The Gas Machinery Co., Cleveland, O 240
The Jeffrey Manufacturing Co., Columbus, O 254
United Gas Improvement Co., Philadelphia, Pa 251
Western Gas Construction Co., Fort Wayne, Ind 264

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md 257
B. E. Chollar, St. Louis, Mo 248
California Light and Fuel Co., San Francisco, Cal 258
Economical Gas Apparatus Construc'n Co, Toronto, Ont. 237
Fred. Bredel Co., Milwaukee, Wis 254
Humphreys & Glasgow, New York City 259
The Gas Machinery Co., Cleveland, O 240
United Gas Improvement Co., Philadelphia, Pa 251
Western Gas Construction Co., Fort Wayne, Ind 264

SCRUBBERS AND CONDENSERS.

Continental Iron Works, Brooklyn, N. Y 258
Cruse-Kemper Co., Philadelphia, Pa 244
Davis & Farnum Mfg. Co., Waltham, Mass 256
Economical Gas Apparatus Construc'n Co., Toronto, Ont 237
Fred. Bredel Co., Milwaukee, Wis 254
Isbell-Porter Co., Newark, N. J 244
Kerr Murray Mfg. Co., Fort Wayne, Ind 256
Logan Iron Works, Brooklyn, N. Y 260
R. D. Wood & Co., Philadelphia, Pa 258
Riter-Conley Mfg. Co., Pittsburgh, Pa 259
Stacey Mfg. Co., Cincinnati, O 259
The Gas Machinery Co., Cleveland, O 240
Western Gas Construction Co., Fort Wayne, Ind 264

PRODUCER POWER PLANTS.

Economical Gas Apparatus Construc'n Co., Toronto, Ont. 237
R. D. Wood & Co., Philadelphia, Pa 258

TAR AND CARBONIC ACID EXTRACTOR.

Economical Gas Apparatus Construc'n Co., Toronto, Ont. 237
Fred. Bredel Co., Milwaukee, Wis 254
Isbell-Porter Co., Newark, N. J 244
Kerr Murray Mfg. Co., Fort Wayne, Ind 256
Stacey Mfg. Co., Cincinnati, O 259
The Gas Machinery Co., Cleveland, O 240
Western Gas Construction Co., Fort Wayne, Ind 264

AMMONIA CONCENTRATORS.

Fred. Bredel Co., Milwaukee, Wis 254
Kerr Murray Mfg. Co., Fort Wayne, Ind 256
Michigan Ammonia Works, Detroit, Mich 236
The Gas Machinery Co., Cleveland, O 240
Western Gas Construction Co., Fort Wayne, Ind 264

GAS METERS.

American Meter Co., New York and Philadelphia. 263
Detroit Meter Company, Detroit, Mich..... 263
D. McDonald & Co., Albany, N. Y..... 261
Helme & McIlhenny, Philadelphia, Pa..... 263
John J. Griffin & Co., Philadelphia, Pa. 260
Keystone Meter Co., Royersford, Pa..... 260
Maryland Meter and Mfg. Co., Baltimore, Md..... 260
Metric Metal Co., Erie, Pa..... 261
Nathaniel Tufts Meter Co., Boston, Mass..... 260
New York Improved Meter Co., New York City 262
Pittsburgh Meter Co., Pittsburgh, Pa 261
Rotary Meter Co., New York City..... 259

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia..... 263
D. McDonald & Co., Albany, N. Y..... 261
Helme & McIlhenny, Philadelphia, Pa..... 263
John J. Griffin & Co., Philadelphia, Pa..... 260
Keystone Meter Co., Royersford, Pa..... 262
Nathaniel Tufts Meter Co., Boston, Mass..... 262
New York Improved Meter Co., New York City..... 262
Pittsburgh Meter Co., Pittsburgh, Pa..... 261

PREPAYMENT METER ATTACHMENTS.

New York Improved Meter Co., New York City 262
Reeves Mfg. Co., New Haven, Conn..... 259

WATER METERS.

Pittsburgh Meter Co., Pittsburgh, Pa..... 261

GAS AND WATER PIPES.

Davis & Farnum Mfg. Co., Waltham, Mass..... 256
Donaldson Iron Co., Emaus, Pa..... 248
Economical Gas Apparatus Construc'n Co., Toronto, Ont. 237
R. D. Wood & Co., Philadelphia, Pa..... 258
Warren Foundry and Machine Co., New York City..... 248

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila. 254
Perkins Co., New York City..... 254
Westmoreland Gas Coal Co., Philadelphia, Pa..... 255

SPECIALTIES FOR OIL AND PIPE LINES.

S. R. Dresser, Bradford, Pa..... 242

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., New York City..... 242

MAIN AND SERVICE LAYING.

Sullivan Bros., Flushing, N. Y..... 242

GAS TAPPING MACHINES.

George Light, Dayton, O..... 248
H. Mueller Manufacturing Co., Decatur, Ills..... 246

CANNEL COALS.

Perkins & Co., New York City..... 254

STOKING MACHINERY.

G. A. Bronder, New York City..... 255

CONVEYORS.

Adam Weber Sons, New York City..... 252
Cruse-Kemper Co.. Philadelphia, Pa..... 244
C. W Hunt Company, New York City..... 245
Dodge Coal Storage Co., New York City..... 248
Economical Gas Apparatus Construc'n Co., Toronto, Ont 237
Fred. Bredel Co., Milwaukee, Wis..... 254
G. A. Bronder, New York City..... 255
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 256
Link-Belt Co., Philadelphia and Chicago..... 245 248
The Gas Machinery Co., Cleveland, O..... 240
The Jeffrey Manufacturing Co., Columbus, O..... 254
Western Gas Construction Co., Fort Wayne, Ind..... 261

CHARGING BARROWS & COAL WAGONS.

Davis & Farnum Mfg. Co., Waltham, Mass..... 256
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 256
Stacey Mfg. Co., Cincinnati, O..... 259

GAS ENRICHERS.

Standard Oil Co., New York City..... 254
Sun Company, Pittsburgh, Pa..... 255
The Sun Oil Co., Pittsburgh, Pa..... 255

COKE CRUSHERS.

C. M. Keller, Columbus, Ind..... 235
Fred. Bredel Co., Milwaukee, Wis..... 254
The Jeffrey Manufacturing Co., Columbus, O..... 254

GAS METER CONNECTIONS.

H. Mueller Manufacturing Co., Decatur, Ills..... 246

GAS COCKS.

H. Mueller Manufacturing Co., Decatur, Ills..... 246

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 240

GAS GOVERNORS.

Connelly Iron Sponge & Governor Co. New York City. 253
Fred. Bredel Co., Milwaukee, Wis. 254
Isbell-Porter Co., Newark, N. J..... 244
Johnson-Reynolds Co., Anderson, Ind..... 255
Pittsburgh Meter Co., Pittsburgh, Pa..... 261
R. D. Wood & Co., Philadelphia, Pa..... 258

CEMENTS.

C. L. Gerould, Pittsburgh, Pa..... 252

RETORTS AND FIREBRICKS.

Adam Weber Sons (Albert J. Weber's Construction)... 252
Baltimore Retort and Firebrick Co., Baltimore, Md.. 252
Brooklyn Firebrick Works, Brooklyn, N.Y..... 252
Henry Maurer & Son, New York City..... 252
James Gardner, Jr., Co., Pittsburgh, Pa..... 252
J. H. Gautier & Co., Jersey City, N. J..... 252
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 240
Missouri Firebrick Co., St. Louis, Mo..... 253
National Pyrogranit Co., New York City..... 252
Parker-Russell Mining and Mfg. Co., St. Louis, Mo.... 253
St. Louis Gas Construction Co., St. Louis, Mo..... 252

(Continued on page 2 7.)

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(*Concluded from page 236.*)

INCLINED RETORTS.

Adam Weber Sons (Graham-Morton [England] System) 252
Baltimore Retort and Firebrick Co., Baltimore, Md 252
Fred. Bredel Co., Milwaukee, Wis..... 254
Parker-Russell Mining and Mfg Co., St. Louis, Mo..... 253
St. Louis Gas Construction Co., St. Louis, Mo..... 252

VERTICAL S'S.

Adam Weber Sons, New York City..... 252
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 253
Fred. Bredel Co., Milwaukee, Wis..... 254
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 253
St. Louis Gas Construction Co., St. Louis, Mo.... 252

VERTICAL RETORTS, CHARGING AND DISCHARGING VERTICALLY.

Adam Weber Sons, New York City..... 252

REGENERATIVE FURNACES.

Adam Weber Sons, New York City. 252
Baltimore Retort and Firebrick Co., Baltimore, Md..... 252
Bartlett, Hayward & Co., Baltimore, Md..... 257
Fred. Bredel Co., Milwaukee, Wis,..... 254
J. H Gautier & Co., Jersey City, N. J..... 252
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 240
Missouri Firebrick Co., St. Louis, Mo..... 252
Parker-Russell Mining and Mfg. Co., St Louis, Mo. ... 253
St. Louis Gas Construction Co., St. Louis, Mo..... 252

SELF-SEALING MOUTHPIECE DOORS.

Continental Iron Works, Brooklyn, N. Y..... 260
Davis & Farnum Mfg Co., Waltham, Mass..... 256
Fred. Bredel Co., Milwaukee, Wis..... 254
Isbell-Porter Co., Newark, N. J..... 244
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 256
Logan Iron Works, Brooklyn, N. Y..... 260
R. D. Wood & Co., Philadelphia, Pa..... 258
Stacey Mfg. Co., Cincinnati, O 259
The Gas Machinery Co., Cleveland, O..... 240
Western Gas Construction Co., Fort Wayne, Ind..... 264

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City..... ... 252

INCANDESCENT GAS LAMPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 198
General Gas Light Co., Kalamazoo, Mich..... 238
Welsbach Company, Gloucester, N. J..... 240

BURNERS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 198
Wm. M. Crane Co., New York City..... 242

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 198

STREET LAMPS.

Thos. T. W. Miner, New York City..... 248
Welsbach Street Lighting Co., New York and Phila .. 250

PURIFIERS.

Connelly Iron Sponge & Governor Co., New York City.. 253
Cruse-Kemper Co., Philadelphia, Pa.... 244
Davis & Farnum Mfg. Co., Waltham, Mass..... ... 256
Fred. Bredel Co., Milwaukee, Wis. 254
Isbell-Porter Co., Newark, N. J..... 244
Kerr Murray Mfg. Co., Fort Wayne, Ind.... 256
R. D. Wood & Co., Philadelphia, Pa..... 258
Stacey Mfg. Co., Cincinnati, O.. 259
Western Gas Construction Co., Fort Wayne, Ind. 264

PURIFYING MATERIALS.

Connelly Iron Sponge & Governor Co., New York City.. 253
Greenpoint Chemical Works, Brooklyn, N. Y..... 256

VALVES.

Continental Iron Works, Brooklyn, N. Y.. 258
Davis & Farnum Mfg. Co., Waltham, Mass..... 256
Economical Gas Apparatus Construc'n Co, Toronto, Ont 237
Isbell-Porter Co., Newark, N. J..... ... 244
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 256
Ludlow Valve Manufacturing Co., Troy, N. Y..... 245
R. D. Wood & Co., Philadelphia, Pa..... 258
Stacey Mfg. Co., Cincinnati, O..... 259
The P. H. & F. M. Roots Co., Connersville, Ind..... 247
Western Gas Construction Co., Fort Wayne, Ind.... .. 264

EXHAUSTERS.

Connelly Iron Sponge & Governor Co., New York City.. 253
Connersville Blower Co., Connersville, Ind..... 241
Davis & Farnum Mfg. Co., Waltham, Mass..... .. 256
Isbell-Porter Company, Newark, N. J..... ... 244
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 256
The P. H. & F. M. Roots Co., Connersville, Ind..... 247

PURIFIER SCREENS.

John Cabot, Hoboken, N. J..... 240
Western Gas Construction Co., Fort Wayne, Ind..... 264

GAS STOVES.

American Meter Co., New York and Philadelphia..... 253
Keystone Meter Co., Royersford, Pa... 262
Maryland Meter & Manufacturing Co., Baltimore. Md. 262
Nathaniel Tufts Meter Co., Boston, Mass..... 262

HOT WATER HEATERS.

Humphrey Co., Kalamazoo, Mich..... 243

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y..... 248

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 257
Continental Iron Works, Brooklyn, N. Y..... 258
Cruse-Kemper Co., Philadelphia, Pa. 244
Davis & Farnum Mfg. Co., Waltham, Mass,..... 256
Deily & Fowler, Philadelphia, Pa.... 260
Economical Gas Apparatus Construc'n Co., Toronto, Ont 237
Kerr Murray Mfg. Co., Fort Wayne, Ind. 256
Logan Iron Works, Brooklyn, N. Y..... 260
R. D. Wood & Co., Philadelphia, Pa. 258
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 259
Stacey Mfg Co., Cincinnati, O..... 259
Western Gas Construction Co., Fort Wayne, Ind..... 264

STORAGE TANKS.

Davis & Farnum Mfg. Co., Waltham, Mass..... 256
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 256
Stacey Mfg. Co., Cincinnati, O..... 259
Western Gas Construction Co., Fort Wayne, Ind..... 264

PAINTS.

American Standard Composition Co., New York City.. 243

PATENTS, TRADE-MARKS, COPYRIGHTS.

Royal E. Burnham, Washington, D. C. 240

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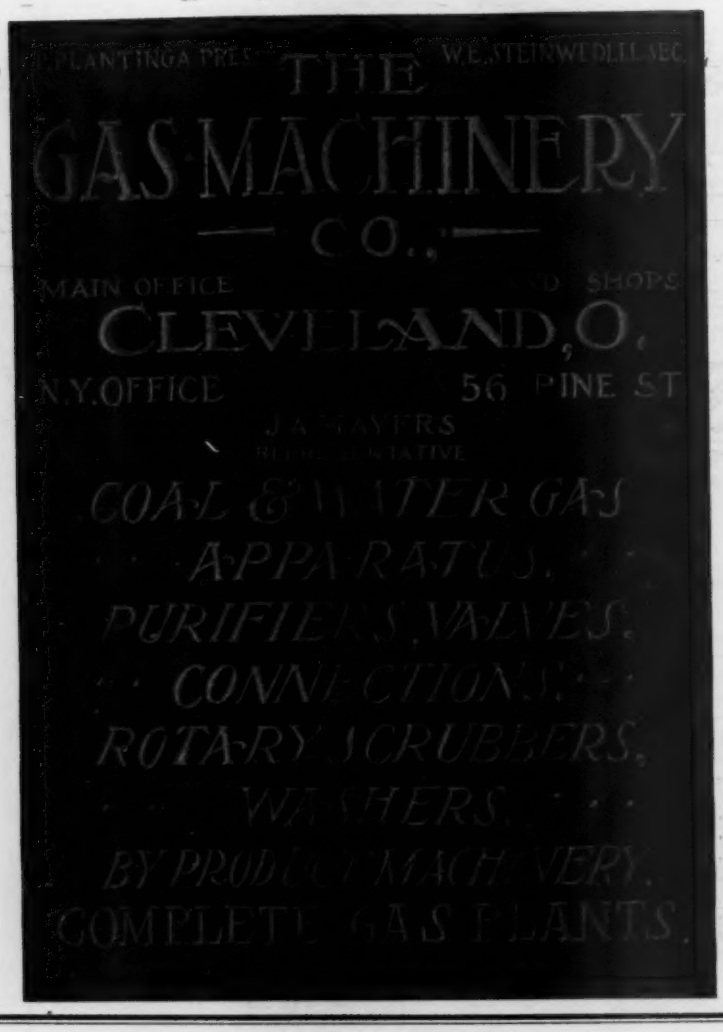

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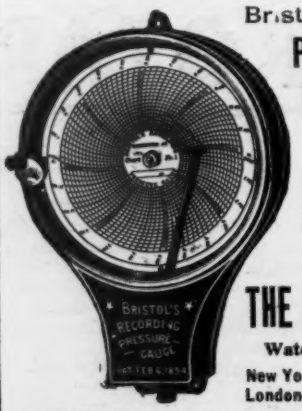

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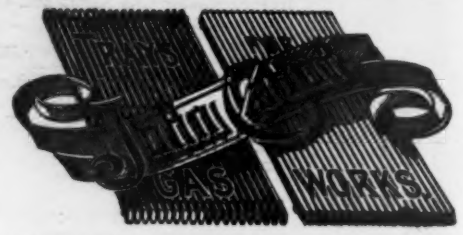

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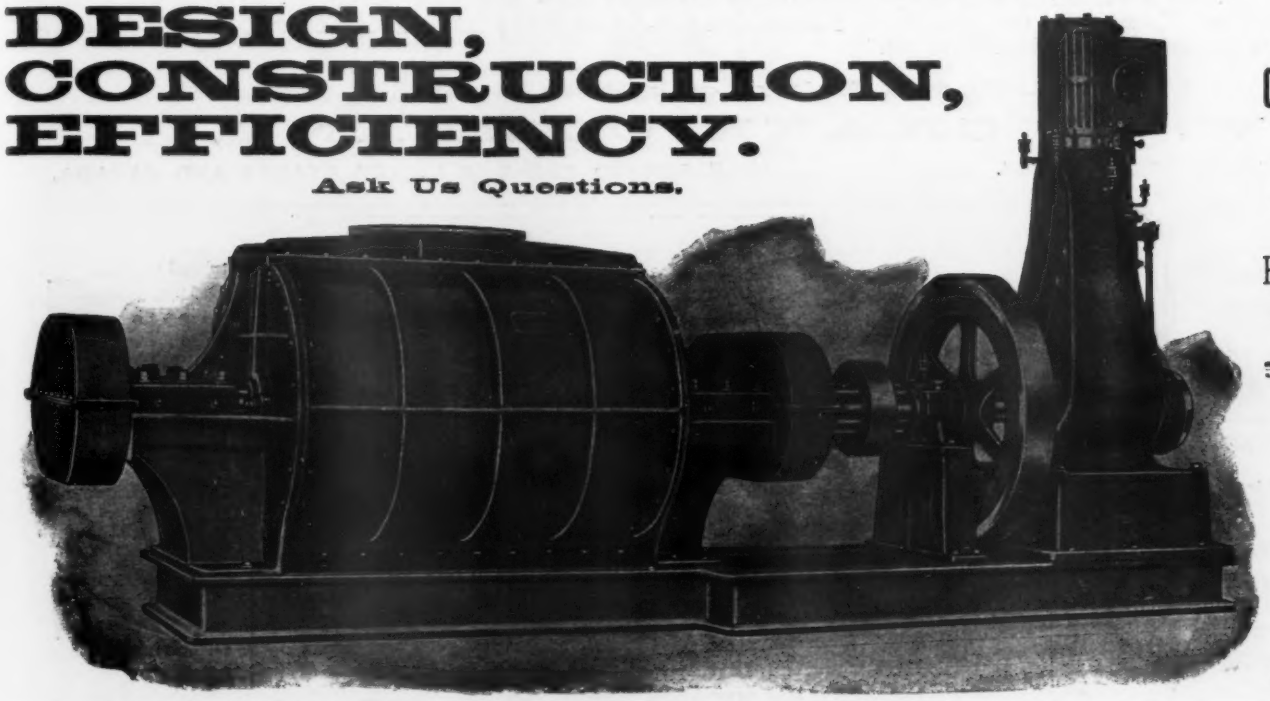

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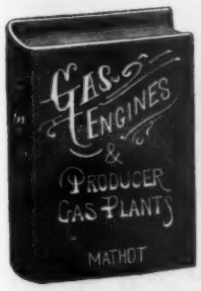

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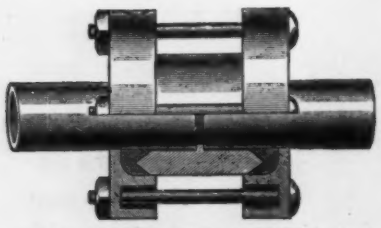

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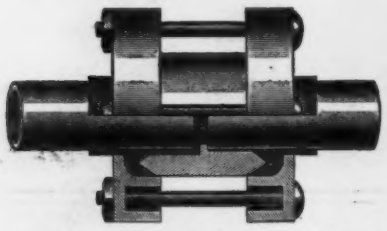
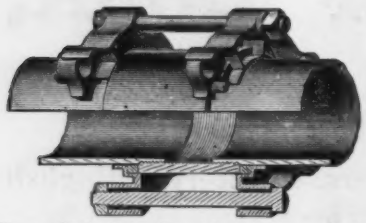


Insulating Coupling, Style 5, for Plain End Wrought Iron Pipe,



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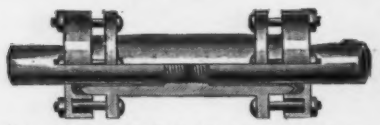

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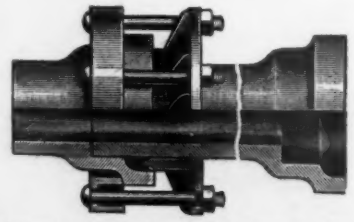
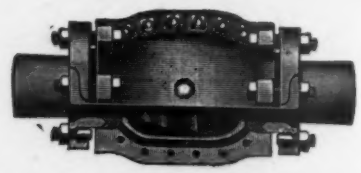


Coupling, Style 9, for Special Style Cast Iron Pipe.



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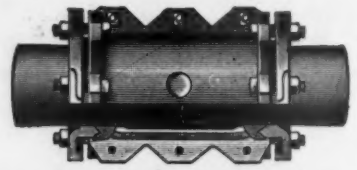

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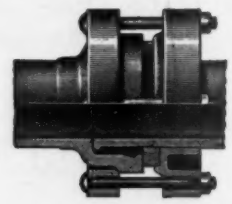

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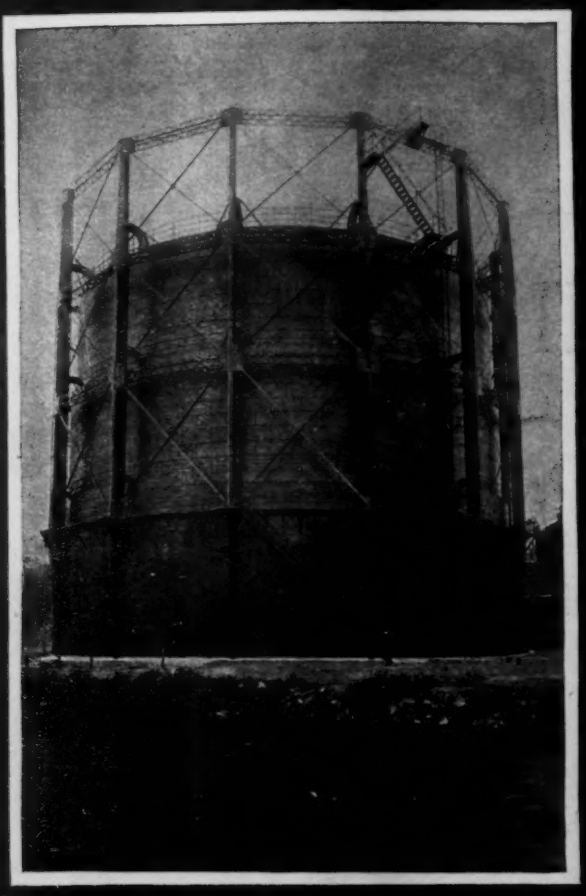

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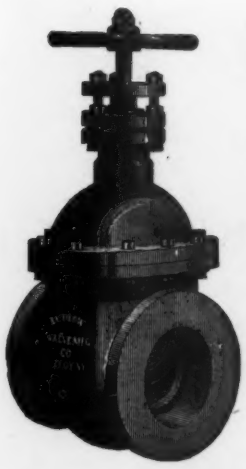

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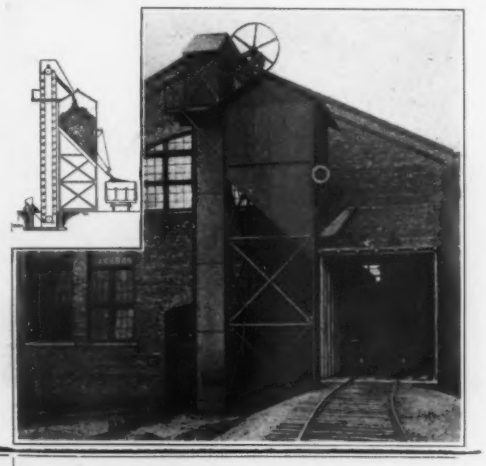

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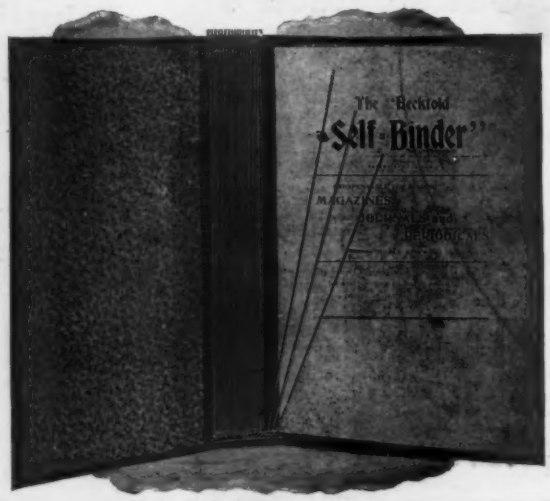

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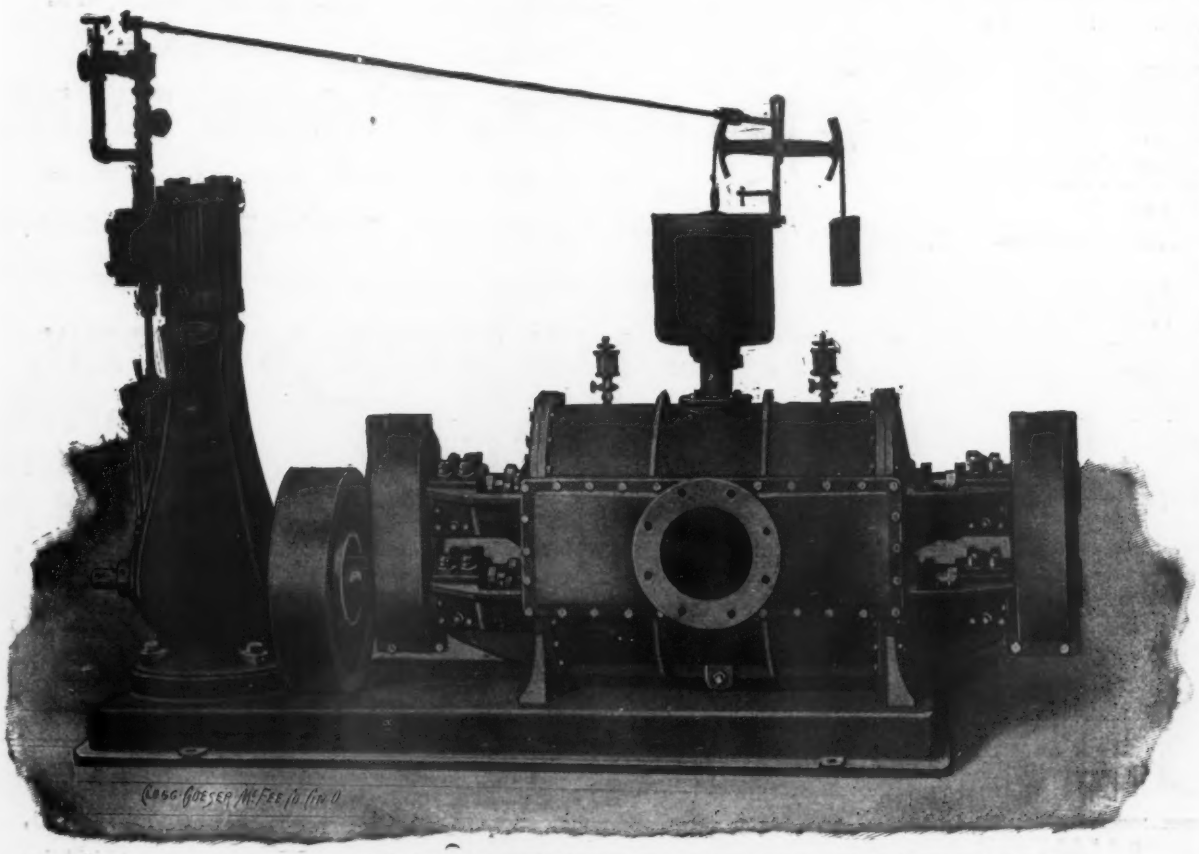

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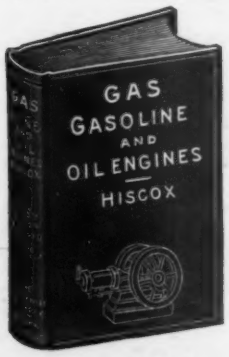

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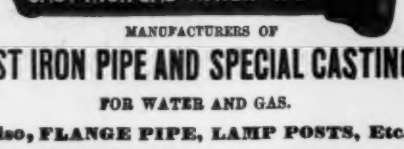

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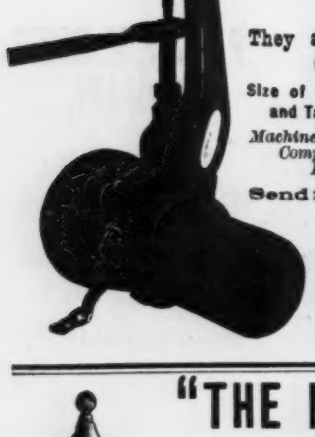

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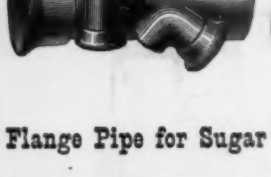

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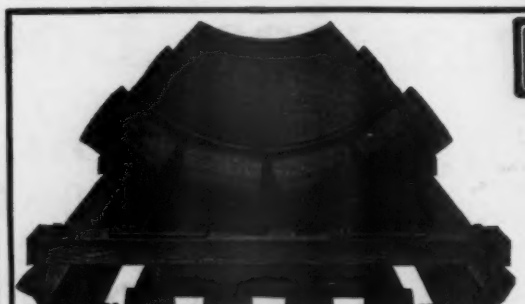

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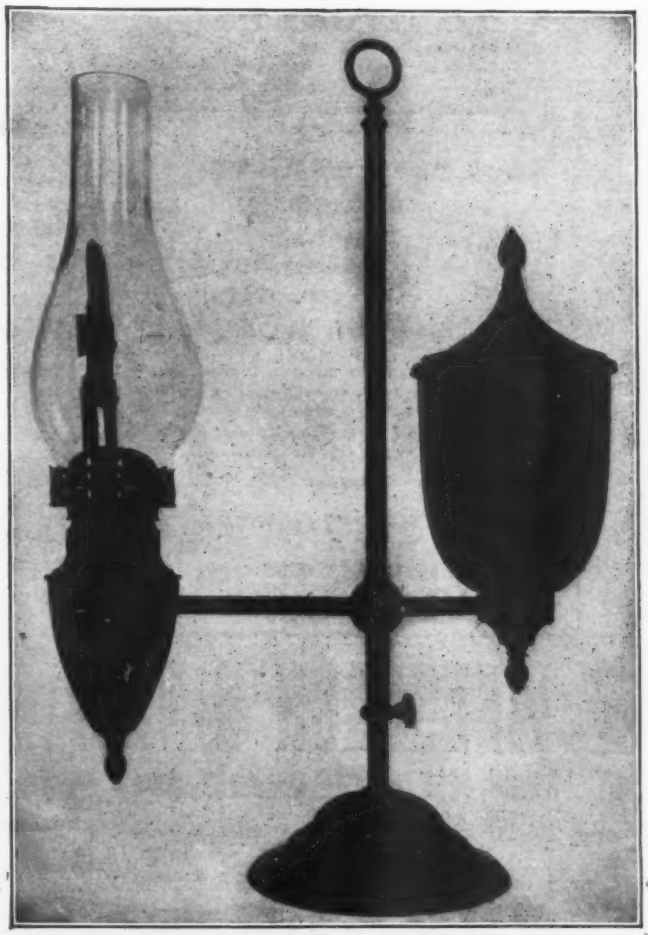
Wed.	1	1.50 AM	4.00 AM
Thu.	2	2 50	4.00
Fri.	3	No L.	No L.
Sat.	4	No L. FM	No L.
Sun.	5	No L.	No L.
Mon.	6	7.40 PM	9.40 PM
Tue.	7	7.40	10.10
Wed.	8	7.40	10.40
Thu.	9	7.40	11.10
Fri.	10	7.40	11.40
Sat.	11	7.40 LQ	12.10 AM
Sun.	12	7.30	12.40
Mon.	13	7.30	1.20
Tue.	14	7.30	2.00
Wed.	15	7.30	2.50
Thu.	16	7.30	4.10
Fri.	17	7.30	4.10
Sat.	18	7.30	4.10
Sun	19	7.20 NM	4.20
Mon.	20	7.20	4.20
Tue.	21	7.20	4.20
Wed.	22	7.20	4.20
Thu.	23	7.20	4.20
Fri.	24	8.40	4.20
Sat.	25	9.20	4.20
Sun.	26	10.00 FQ	4.20
Mon.	27	10.50	4.20
Tue.	28	11.40	4.20
Wed.	29	12.40 AM	4.20
Thu.	30	1.40	4.20
Fri.	31	2.50	4.20

TOTAL HOURS DURING 1906.

By Table No. 1.

	Hrs.Min.
January	223.40
February	190.40
March	192.10
April	167.00
May	152.20
June	142.10
July	150.20
August	157.40
September	170.00
October	185.10
November	201.40
December	214.00
Total, yr.	2146.50



THE ELLIOTT KEROSENE STANDARD PHOTOMETER LAMP.

***

10-Candle Power.

***

This lamp is a perfect substitute for the 10-candle Pentane Lamp hitherto used, and has the following advantages:

1st. It uses Standard Kerosene Oil (Pratt's Astral Oil or equivalent).

2d. It is remarkably steady. Will burn 24 hours continuously with less than 2 per cent. variation.

3d. It is much less dangerous than Pentane, which is a kind of gasolene.

4th. It is not easily affected by air currents in the photometer room.

5th. Since the lamp may burn continuously, the candle power of gas may be taken at any moment, if necessary. This insures steady illuminating power without waste of carburetting material.

6th. The first cost of the lamp brings it within the reach of even small gas works.

7th. Costs much less to maintain than a Pentane lamp or sperm candles doing the same service.

8th. Is not affected by the weather.

PUBLIC LIGHTING TABLE.

AUGUST, 1906.

Day of Week.	Date.	Table No. 2. NEW YORK CITY. All Night Lighting. Light	Extinguish.
		P. M.	A.M.
Wed.	1	7.10	3.30
Thu.	2	7.10	3.30
Fri.	3	7.10	3.30
Sat.	4	7.10	3.30
Sun.	5	7.10	3.30
Mon.	6	7.10	3.45
Tue.	7	7.10	3.45
Wed.	8	7.10	3.45
Thu.	9	7.10	3.45
Fri.	10	7.10	3.45
Sat.	11	7.10	3.45
Sun.	12	7.10	3.45
Mon.	13	6.55	4.00
Tue.	14	6.55	4.00
Wed.	15	6.55	4.00
Thu.	16	6.55	4.00
Fri.	17	6.55	4.00
Sat.	18	6.55	4.00
Sun.	19	6.55	4.00
Mon.	20	6.45	4.10
Tue.	21	6.45	4.10
Wed.	22	6.45	4.10
Thu.	23	6.45	4.10
Fri.	24	6.45	4.10
Sat.	25	6.45	4.10
Sun.	26	6.45	4.10
Mon.	27	6.30	4.20
Tue.	28	6.30	4.20
Wed.	29	6.30	4.20
Thu.	30	6.30	4.20
Fri.	31	6 30	4.20

TOTAL HOURS DURING 1906.

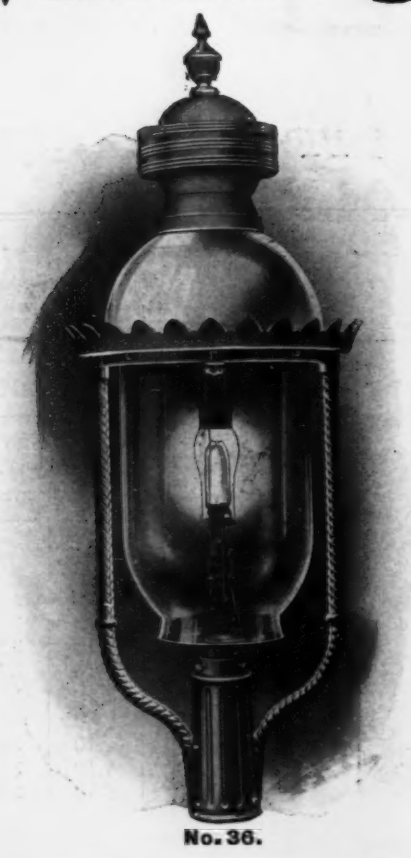
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street. BOSTON, 820 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, 218 La Salle Street. SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY

....OF AMERICA....



No. 36.

Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

THE NEW NO. 7 WELSBACH DINING ROOM FIXTURE.

PRICE, EACH, COMPLETE, WITH SHADE, FRINGE, MANTLE AND CHIMNEY, $14. PER DOZ., $150. DISCOUNT, 50 PER CT.

Standard Length, 30 inches.
The New No. 7 Welsbach Dining Room Fixture, when ordered, will be sent complete, as follows:

1 No. 7 Harp Fixture and Brass Crown finished in Brushed Brass.
1 No. 66 Welsbach Burner (high candle power).
1 No. 4 Pilot By-pass.
1 No. 4197 Mantle — Intensive Brand.
1 No. 306 Chimney (air hole).
1 Fourteen-inch GREEN Art Glass Shade, with six-inch Green Beaded Fringe.

VARIATIONS.

Finished in oxidized copper, oxidized brass, etc., 25 cents extra.

Shades in Ruby and Green--Ruby, Amber and other colors, without extra charge.

Special colors require a few days extra time to fill orders.

Green Shades will be shipped unless otherwise ordered.

This fixture is being largely used by Gas Companies as a dining room fixture at the popular retail price of $10 complete, and is a great favorite for moderate sized two and three-story residences. In popularity and price it is unequalled.

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Salesrooms in All the Principal Cities of the United States.

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THE UNITED GAS IMPROVEMENT COMPANY

For the Six Months Ending July 1st, 1906, has been Awarded Contracts for 25 Sets of

Standard Double-Superheater Lowe Water Gas Apparatus.

PARTIAL LIST OF PLACES:

New Britain, Conn. (2d contract).
Malden, Mass. (3d contract).
Kirksville, Mo.
St. Johnsbury, Vt.
Memphis, Tenn. (2d contract).
Council Bluffs, Ia. (2d contract).
Seattle, Wash. (2d contract).
Philadelphia, Pa.
Waterbury, Conn.
Manchester, N. H.
Allentown, Pa.
Omaha, Neb.
Muskegon, Mich.
Nazareth, Pa. (2d contract).
Lewiston, Pa.
Greenville, Tex.
New York, Cent. Un. (3d contract).
Jefferson City, Mo.
Peekskill, N. Y. (2d contract).
Waterville, Me.
Washington, D. C. (3d contract).

TOTAL SETS TO JULY 1, 1906, - - - - - 618
TOTAL DAILY CAPACITY TO JULY 1, 1906, 488,930,000 CUBIC FEET.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
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FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

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FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
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CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

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SPECIAL HIGH GRADE REFRACTORY MATERIAL FOR BENCH SETTINGS AND WATER GAS LININGS,

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CHRISTY SETTINGS.

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For Students in Gas Manufacture.
ELEMENTARY, ADVANCED AND CONSTRUCTIONAL.

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Manhattan Fire Brick and Enameled Fire Clay Retort Works.

Works at Weber, on the Raritan River. Middlesex County, New Jersey.

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Modern Coal Gas Benches,

With either Horizontal or Vertical Retorts, Half-Depth and Full-Depth Recuperative Furnaces.

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STANDARD BENCH IRONWORK.

Linings for Water Gas Apparatus, High Grade Fire Brick of All Shapes and Sizes, Ground Fire Clay, Ground Fire Brick in Bulk or in Barrels.

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Works,
LOCKPORT STATION, PA.

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Manufacturers of all Material for the Construction of Coal Gas Benches.

HALF AND FULL DEPTH AND FREE FIRING BENCHES,

All styles of which we have in operation, equipped with the BEST of LATEST IMPROVEMENTS, proving our claim for SUPERIOR QUALITY and EFFICIENCY.

INCLINES—We have in SUCCESSFUL OPERATION benches of Inclined Retorts, MANUFACTURED and ERECTED by us.

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Agents for New England States.

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RAIL and WATER CONNECTIONS to ALL POINTS.

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A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

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An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 37th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by
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JOHN DELL,
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ESTABLISHED 1882.

MANUFACTURERS OF

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Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada.

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These are the only machines that will draw or charge simultaneously 3 or 4 retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

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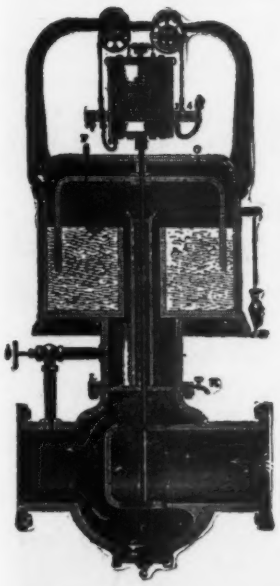

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Automatic, Balance, High Pressure and Service Governors,

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Iron Sponge, Purifying Material for Gas Purification, Jones Jet Photometers, Pressure Registers, etc.,

INSTALLATION OF SMOKELESS TAR BURNING SYSTEM.

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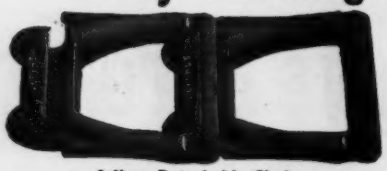

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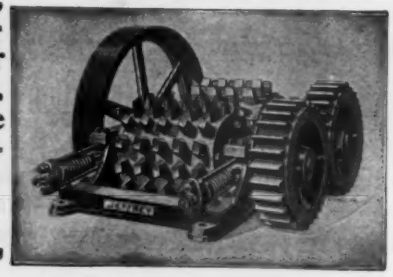

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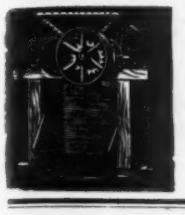

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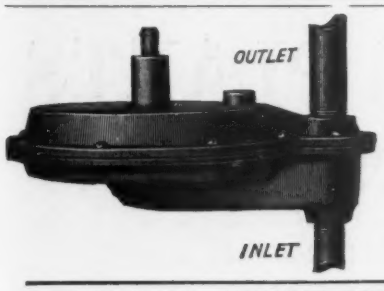

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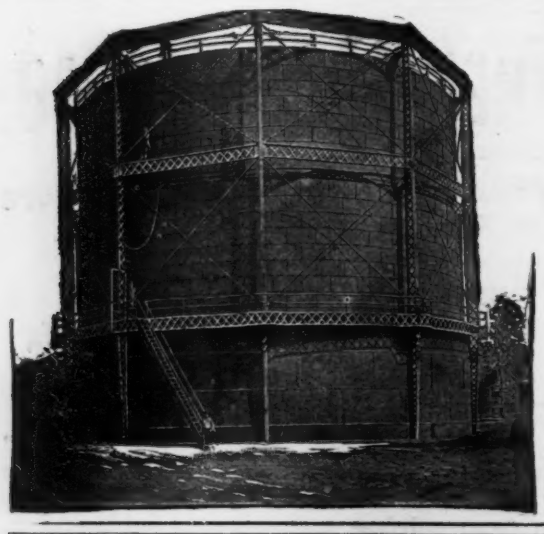

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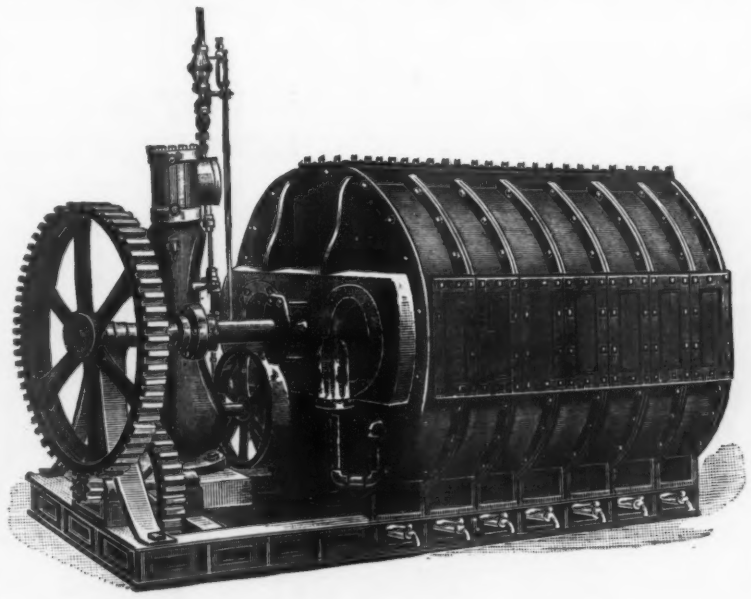

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PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Disks, thus reducing the weight on shaft and power for operating same.

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BENCHES WITH INCLINED RETORTS.

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GASHOLDERS OF ALL SIZES.

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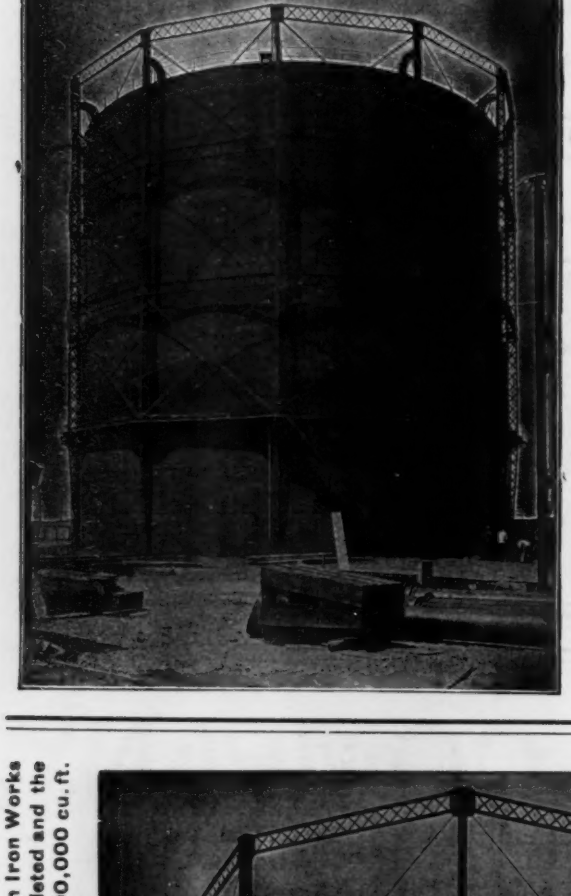

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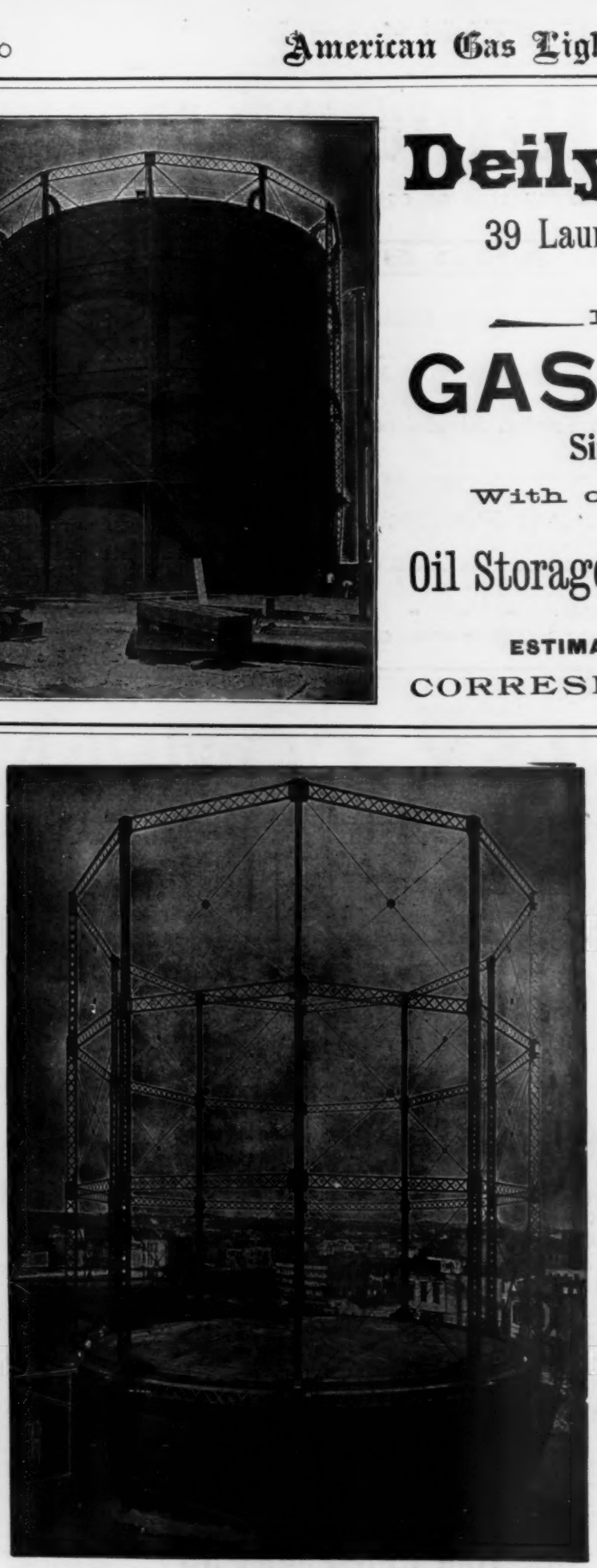

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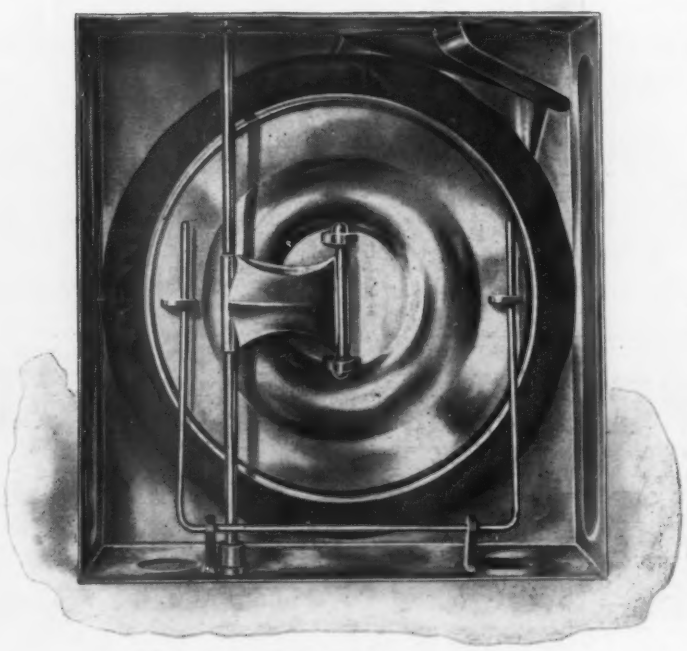

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